

MANUAL FOR THE USE OF THE STETHOSCOPE.

A

SHORT TREATISE

ON THE

DIFFERENT METHODS OF INVESTIGATING

THE

DISEASES OF THE CHEST.

TRANSLATED FROM THE FRENCH OF M. COLLIN. ✓

BY W. N. RYLAND, M. D.

FROM THE THIRD LONDON EDITION; WITH PLATES,

AND AN

EXPLANATORY INTRODUCTION,

BY

A FELLOW OF THE MASSACHUSETTS MEDICAL SOCIETY.

Ham. Will you play upon this pipe?

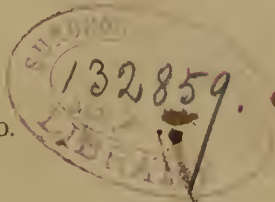
Guil. My lord, I cannot—I have not the skill.—*Shakspeare.*

—◆—
BOSTON:

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"Manual for the use of the Stethoscope. A short treatise on the different methods of investigating the diseases of the Chest. Translated from the French of M. Collin. By W. N. Ryland, M. D. From the third London edition; with plates, and an explanatory introduction, by a Fellow of the Massachusetts Medical Society.

Ham. Will you play upon this pipe?

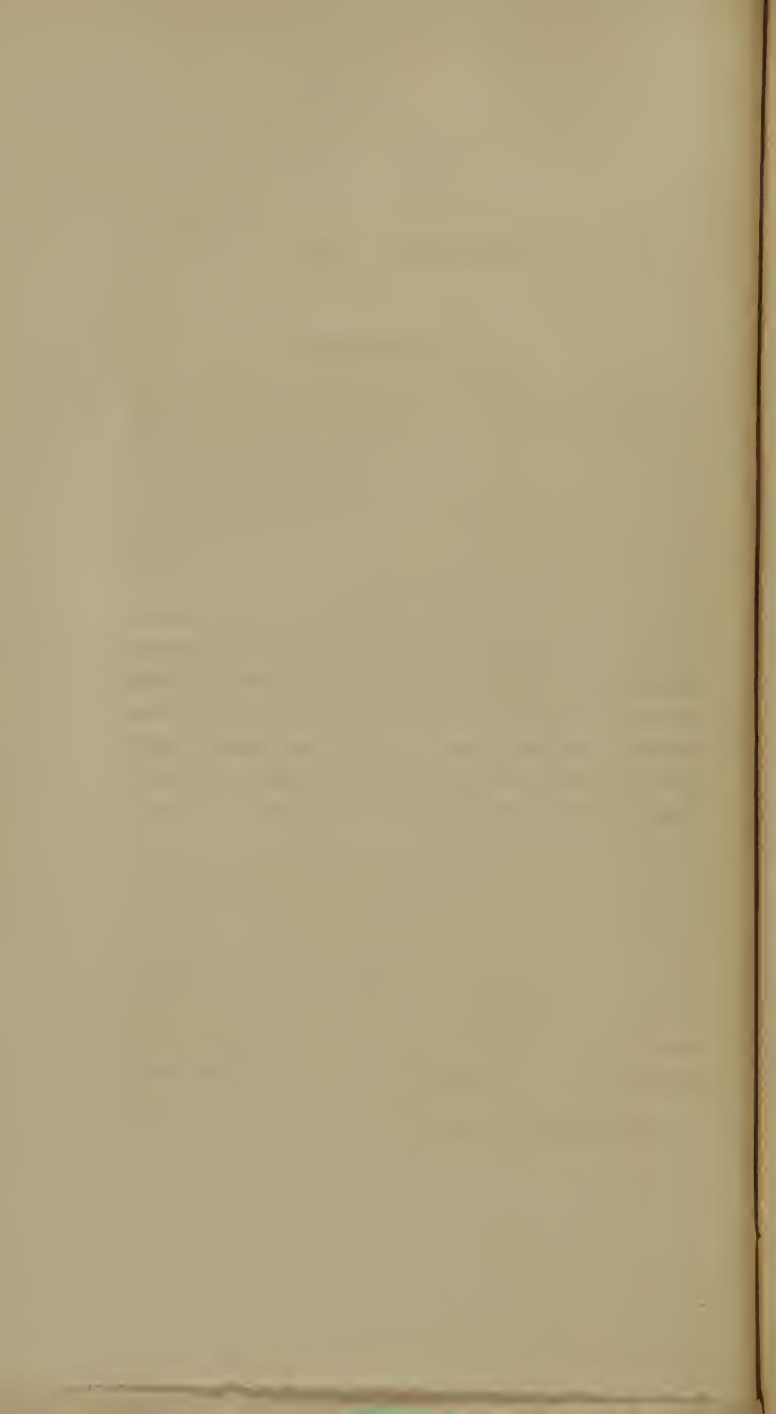
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IN preparing for the American press the English translation of the well known and highly useful work of M. Collin, which translation has passed through three editions in England, the editor thinks he can render it more acceptable by dispensing with the various prefaces and introductory remarks which encumber the last edition ; and by substituting in their place an entirely new introduction, which is intended to embrace the amount of all that is important in the prefaces alluded to, as well as that which is contained in various abstracts and reviews which have appeared of treatises upon the different methods of investigating thoracic diseases, and in some other works which are not generally before the profession in this country.



INTRODUCTION.

AUSCULTATION, or investigating diseases by the sound is, an ancient mode of diagnosis. It is treated of by Hippocrates, and is, withal, so simple an idea as must have been very obvious to all observers of disease. But *mediate auscultation*, that is, hearkening by means of an instrument, was first promulgated as a discovery by M. Lænnec in his elaborate work, *De l'auscultation Médiate*, in 1819. Before this period, the only idea attached to auscultation as a means of diagnosis, was that of applying the ear as nearly as possible to the seat of the disease. The inconveniences of this method are sufficiently obvious, and from this cause, as well as the uncertainty of the signs to be derived from it, it had fallen into merited neglect. "I was consulted," says M. Lænnec,* "in 1816, by a young woman, who presented some general symptoms of disease of the heart, in whose case the application of the hand and percussion gave but slight indications, on account of her corpulency. On account of the age and sex of the patient, the common modes of exploration being inapplicable, I was led to recollect a well known acoustic phenomenon, namely, if the ear be applied to one extremity of a beam, a person can,

* *Traité de l'aus. méd.* tom 1. p. 7.

very distinctly, hear the scratching of a pin at the other end. I imagined this property of bodies might be made use of in the present case. I took a quire of paper which I rolled together as closely as possible, and applied one end to the præcordial region ; by placing my ear at the other end, I was agreeably surprised at hearing the pulsation of the heart much more clearly and distinctly than I had ever been able to do by the *immediate* application of the ear.

“I henceforward presumed this method might become very useful and applicable, not only to the study of the pulsation of the heart, but also to that of all those movements within the cavity of the chest, accompanied by sound ; and consequently to the exploration of the respiration, of the voice, of rattling, and perhaps even of the fluctuation of a fluid effused in the pleura or pericardium.

“In this conviction, I commenced immediately at the hospital Neckar, a course of observations, which have resulted in the discovery of new signs, sure, for the most part obvious, easy to be possessed of, and suitable to render the diagnosis of almost all diseases of the lungs, the pleuras, and the heart, more certain, and perhaps more circumstantial, than even the surgical diagnostic signs established by the aid of the probe or the finger.”

Medical experience, for the last ten years, has given abundant proof of the utility of the discovery of M. Lænnec ; and the discoverer has lived just long

enough to bring to perfection his method of diagnosis, to establish his own claims to the permanent gratitude of the profession, and to enrol his name high among medical philosophers. Although the Stethoscope is well thought of by most practitioners, yet it is introduced into practice by a very few only, and ignorance, and prejudice, and perhaps in some instances, honest doubts have conspired to decry its use. But there never was a discovery of importance which had no objectors, and the negative testimony of all the rest of mankind, who *do not* apply the test of experiment, cannot outweigh the affirmative testimony of one competent witness who does do it. The Stethoscope has not wanted for admirers, and is as much in danger from indiscreet friends, as prejudiced opposers. It is at least so far received that a man may quietly use his Stethoscope as well as his stop-watch, and neither be called a quack or a conjurer, and if it be not so necessary to him as a telescope to the astronomer, or a compass to the mariner, yet if he will be at pains to carry it in his pocket and acquire a little readiness in its application, he may rest assured that he will obtain assistance in discriminating in many perplexing cases of a class of diseases the most numerous and fatal of all those of a New England climate.

“The actions going on in the chest are, the entrance and exit of the air in respiration, the voice, the motion of the blood in the heart, and blood vessels; and so perfectly do all these declare themselves to a per-

son listening through the Stethoscope, that an ear once familiar with the natural and healthy sounds, instantly detects certain deviations from them. Hence this instrument becomes a means of ascertaining diseases in the chest almost as effectual as if there were convenient windows for visual inspection; and when it is considered that a fourth or fifth part of the inhabitants of Europe, die of diseases of the chest, such as inflammations, abscesses, consumptions, dropsical collections, aneurisms, and various affections of the heart and blood vessels, which require an appropriate treatment, the importance of such a means may be truly judged of.”*

The use of the Stethoscope has become familiar to many of the most enlightened and distinguished practitioners of Europe. In England it is ordered to be used generally by the army surgeons, who are required to report their observations; in this country it still remains a novelty.

A correct diagnosis of thoracic diseases not only greatly involves the reputation of the practitioner, but in the highest degree, the safety and well-doing of the patient. The symptoms usually described as denoting Hydrothorax, equally belong to certain forms of pneumonia; and what can be more widely different than the appropriate treatment of those two diseases? It has been stated† “that no practical er-

* Arnott's Elements of Physics, 2d edition, p. 488-9.

† Dr. Groves' and Dr. Stokes' Medical Cases, in Meath Hospital. Dublin Hosp. Rep. vol. 4.

ror is of more frequent occurrence than the attributing to Hydrothorax, symptoms which belong to pneumonia. Numerous cases have been sent into the medical wards of the Meath Hospital, by practitioners who had named and treated them as cases of simple Hydrothorax ; but in no instance have we found this diagnosis correct, and more than once have we succeeded in saving the life of such a patient, by the bold use of the lancet, at a period of the disease when a reliance on antidropsical remedies alone would have been of no avail." But the case, the most common to the New England practitioner, which calls for additional means of discrimination, is that of diseases simulating *pulmonary consumption*, the scourge of our northern climate. We are called upon by an anxious sufferer to tell him if his disease admit of a remedy, or must be borne without hope. With what industry and perseverance then, should we educate our senses to the use of those methods of investigation, laborious and difficult though they be, which promise to enable us satisfactorily to resolve such a question.

The following case, taken from a modern work,* is the best answer to one who asks what good is to be derived from the diagnosis of consumptive diseases. "M. Lænnec was consulted, in the case of a gentleman, who was supposed to be dying from Phthisis Pulmonalis, and in a state so desperate that he was

* Observations on M. Lænnec's Method, &c. &c., by Charles Scudamore, M. D. F. R. S. 1826.

not expected by his medical attendant to survive more than two or three days. M. Läennec made his usual investigation, and persuaded himself that the case had been mistaken, and that the alarming symptoms did *not* arise from ulceration of the lungs, but from empyema or purulent collection within the pleura. He strongly recommended that the operation for this disease should be performed ; and after a little hesitation and delay, his advice was adopted. A large quantity of pus was evacuated, and immediate relief was afforded. The amendment was rapid, and the progress of cure so favorable, that the gentleman recovered his health in less than three months." It is especially desirable in the diseases of the chest of infants, who cannot communicate their sensations by words, that we should employ those means which may make their symptoms obvious to our senses without the aid of language. Auscultation, therefore, may be looked upon as a most desirable mean of investigating these diseases.

Percussion and auscultation are intimately connected, and should be studied and practised together. Corvisart was the first to introduce into general notice the employment of percussion, by his translation and notice, in 1808, of the writings of Leopold Avenbrugger, a native of Graets in Styria, published in 1761. This operation consists in striking upon the walls of the thorax, and the sound returned will of course be modified by the state of the viscera of this cavity, so

that to a person accustomed to the sounds afforded by percussion of the thorax in a state of health, the deviations produced by disease will be sufficiently obvious. The sound is obtained with more distinctness, when the lungs are most distended with air, as during inspiration. The best mode of performing percussion is to place the ivory cup, which is annexed to the end of the most approved form of Stethoscope, flat upon the part, and apply a light quick stroke of the fore and middle finger. Every part of the chest may thus be examined, directing the patient to draw in his breath, and retain it while you apply the stroke of percussion. The advantage of the cup is, that you occasion less pain and fix with more certainty the exact spot which yields any unnatural sound.

The Stethoscope, as it was first used by Lænnec, hardly needs a description. It is a simple cylinder of wood perforated in the middle, and used sometimes with a funnel shaped extremity, and sometimes without it; the change being made by putting in or taking out a conical plug, at the end of the instrument which is applied to the chest. It should be made of some fine grained, light wood, such as cedar or maple. The plate at the end of the volume, sufficiently explains the common form of the instrument; the principal objection to which is, that it is too large to be a convenient inmate of the coat pocket. A more portable instrument is one which the editor has found to answer all the purposes of Lænnec's first Stethoscope, and is

little more than half as long, and instead of being cylindrical, is trumpet shaped, with a circular rim, or ear piece, to be serewed upon the small end, when the instrument is used. It has also affixed to it a plate of ivory, which is the pleximeter of M. Piorri, (mentioned page 19) and is employed to prevent the pain of the stroke in pereussion.* As is to be expected the ear must undergo tuition in praetising with the Stethoscope, and the natural phenomena must be studied with great care before the morbid alterations can be pereceived. A beginner should, therefore, not give up in despair, because his first trials are abortive. A very skilful observer has asserted that it required two days study for him to perceive the murmur of respiration, one of the most obvious of the healthy phenomena.

In exploring the movements of the heart there are several circumstances which give a great value to the signs derived from auscultation. It is obvious that all the knowledge we obtain from the examination of the pulse at the wrist, is merely as to the mode of action of the left ventricle of the heart, and that in diseases of the heart, the practieal value of auscultation, which informs us of the movements of both ventrieles and both auricles, must be greatly before that of the examination of the pulse at the wrist. For it is pathognomie of some affections, that the action of the heart, and

* This form of the Stethoscope may be obtained at the publishers.

the fulness and strength of the pulse, are in inverse proportion to each other.

It has been proposed to use the Stethoscope for the diagnosis of other diseases than those of the thoracic contents. Lænnec proposes its use in investigating the diseases of animals, and Lisfranc has applied it with success to distinguish the crepitus of fractured bones. May it not be resorted to with advantage to ascertain the force of the heart's contraction in cases of severe flooding, and thus assist in deciding upon the disputed question of transfusion? The editor has witnessed a case in which, at a period of dangerous exhaustion from this cause, the heart's impulse, as perceived by the Stethoscope, was unexpectedly strong and distinct, and essentially contributed to inspire confidence in a favorable prognosis.

The following are rules useful to be observed in the management of the Stethoscope.

1. To procure stillness in the room in which the patient is placed, although to long practised auscultators, this precaution is in part unnecessary. Lænnec repeatedly asserted that his organ of hearing was so adjusted to distinguish minute difference of sound, that he could, at the same time, observe the movements of the heart—the noises produced during respiration by air, mucus, &c. in the lungs, and in the stomach and intestines; the noise of his own, and the patient's movements; and all this, while his students were moving and whispering round him.

2. The Stethoscope is to be used *without* the stopper, in exploring the phenomena of respiration, and the different *rattles*; and *with it*, to examine the circulation, and the voice.

3. It is not necessary that the part to which the Stethoscope is applied should be uncovered, but only that the covering be not too thick, be perfectly smooth, and not of a kind to produce a rustling noise, as silk or worsted will do.

4. The instrument must be applied perpendicularly, and so retained on the chest as to fit and press equally on every part, and at the same time the ear should be applied to the other extremity so as to exclude the external air, the hole of the cylinder being opposite the meatus auditorius.

5. In examining the respiration, the patient should be directed to respire a little more rapidly than natural, without creating a sound more audible than usual at a distance. In examining the voice, he may count aloud, slowly, in a natural tone of voice; and for exploring the different rattles, the patient should be directed to cough occasionally.

6. The observer should be careful not to place himself in a constrained position, and for this purpose it is often convenient to rest upon one knee.

· Salem, Nov. 1, 1828.

CONTENTS.

PART I.

CHAPTER I.

	Page
Examination of the movements of the Chest in Respiration, -	1
Respiration in Health, - - - - -	2
————— in Disease, - - - - -	3

CHAP. II.

Of Percussion, - - - - -	13
————— in Health, - - - - -	14
————— in Disease, - - - - -	19
New Method of Percussion, - - - - -	19

CHAP. III.

Of Auscultation, - - - - -	23
Natural Phenomena furnished by the Respiration, - - -	28
————— by the Voice, - - - - -	31
————— by the Heart, - - - - -	33
Pathologic Phenomena, - - - - -	38
————— furnished by the Respiration, - - -	38
————— by the Voice, - - - - -	47
————— by the Heart, - - - - -	64
Of Mensuration, - - - - -	77
Of Succussion, - - - - -	81

PART II.

CHAPTER I.

Of Diseases of the Pleura and Lung, - - - - -	83
Comparative value of the various modes of examination, -	83
Of Pleurodynia, - - - - -	87
— Pulmonary Catarrh, - - - - -	88
— Pulmonary Apoplexy, - - - - -	90
— Œdema of the Lung, - - - - -	91
— Emphysema of the Lung, - - - - -	92
— Pneumonia, - - - - -	95
— Empyema and Hydrothorax, - - - - -	101
— Pleurisy, - - - - -	101
— Pulmonary Phthisis, - - - - -	106
— Gangrene of the Lung, - - - - -	110
— Pneumo-thorax, - - - - -	111

CHAP. II.

On the Diseases of the Heart, - - - - -	114
Diseases characterized by the alteration of the shock, - -	124
Hypertrophy, - - - - -	124
Hypertrophy of the left Ventricle, - - - - -	125
—————right ventricle, - - - - -	125
Disease characterized by alteration of the Sound, - - -	126
Dilatation of the Heart, - - - - -	126
Diseases characterized by alteration of impulse and sound, -	127
Dilatation with Hypertrophy, - - - - -	127
Contraction of the Orifices of the Heart, - - - - -	128
Softening of the Heart, - - - - -	128
Aneurism of the Aorta, - - - - -	129
On the use of the Stethoscope in Internal Aneurism, - - -	130
In Pericarditis, and Hydropericardium, - - - - -	131

A

TREATISE,

' &c. &c.

PART I.—CHAP. I.

Examination of the Movements of the Chest in Respiration.

RESPIRATION, like digestion, is a function, which, according to the ingenious idea of Professor Chaussier, requires the taking in of a foreign substance, by the action of voluntary* muscles; it is divided into two acts, inspiration and expiration.

Inspiration is the movement by which the thorax, separating its walls, augments its interior capacity, allowing the air to enter into

* Though correctly translated, the statement appears erroneous; the muscles of respiration, although sometimes aided by voluntary efforts, performing their office independently of the will, as in sleep, &c.

the lungs ; expiration is the return of the walls to their former state.

These movements are always free and easy, so long as no obstacle exists to their perfect exercise ; an affection of the lung, or of the cavity which contains it, will always induce an alteration, generally to be recognized without difficulty. These alterations must be known, but it is first better to give an idea of respiration in the healthy state.

SECTION I.

In a healthy man, unagitated by passion, inspiration and expiration should be performed slowly, without violence and without any muscle seeming to make a painful effort to produce them : they succeed each other with regularity : their rhythm is constant and uniform ; all the ribs rise, and dilatation and contraction are equally marked on each side, except in case of deformity of the thorax.

The succession of the movements is more or less rapid in different individuals ; in general there are from fifteen to twenty respirations in a minute, and of each five

respirations, one is observed to be stronger than the others.

In children, women, and weak individuals, the frequency of respiration is greater. The passions, exertion, or repose, the will, the qualities of the air, cause a variation in it every instant; during sleep it is slower and deeper.

Respiration may be effected by the intercostal and other inspiratory muscles, and is then thoracic, or it may take place by the action of the diaphragm alone, and is then said to be abdominal. Some authors affirm, that during the waking state, it is the diaphragm which contributes most powerfully to this act, and the intercostals during sleep.

SECTION II.

In disease, the movements of the thorax may offer many varieties, which we shall relate in the following divisions. They may be either frequent or rare, quick or slow, regular, or irregular, great or small, equal or unequal, easy or difficult, complete or incomplete; finally, respiration may be either abdominal or entirely thoracic.

To observe these different alterations well, the patient should be made to sit, if his strength will allow of it, in order that nothing may obstruct the muscular motions which assist respiration; the arms should hang freely and the thorax should be uncovered; but usually these precautions are not required.

1st. Considered relatively to the number of inspirations and expirations in a given time, respiration is *frequent* or *rare*; frequent, when, in an adult, more than eighteen or twenty respirations occur in a minute; rare, when a less number occur.

This frequency is natural to children, to women, and persons of a sanguine temperament; in warm climates; in summer, when the air being more rarefied contains less oxygen in a given quantity; and after exercise, or great emotion.

It also occurs independent of all thoracic affection, in verminous complaints, in the spasmodic, and all the pyrexial diseases.

The respiration is usually observed to be rare only in soporose and hysteric affections, and the latter moments of life.

A pain in the thorax ; an obstacle to the free passage of the air through the bronchia ; every alteration which renders a part of the pulmonary tissue unfit for respiration, are the causes of increase of frequency ; suspension of the nervous influence, debility of the muscular powers, are the causes of increased rarity.

2d. Respiration may be *quick* or *slow*. It is quick when the movements of inspiration are short, rapid, and abrupt ; slow, when they are long and gradual. Quick respiration is usually united with frequent respiration ; it is then termed accelerated ; this may be carried to *panting*.

Quick respiration is sometimes combined with the rare in robust subjects, in acute diseases, and in the latter moments of life. Vivacity of respiration appears to depend on the same causes as its frequency. Its slowness is observed in the same circumstances as its rarity, which it often accompanies and depends on the same lesion.

3d. When the inspirations and expirations follow each other at equal intervals, respiration is said to be *regular* ; it is *irregular* when these intervals are more or less prolonged in

relation to each other ; *intermittent*, when one or more inspirations supervene late or not at all ; *interrupted*, when the expiration seems to take place before the inspiration is finished.

These different modifications occur in the phlegmasiæ of the thoracic and abdominal cavities, and particularly in nervous affections. The causes above enumerated may produce them.

4th. Respiration is said to be *great* in those cases in which an inspiration, either slow or quick, attended with a full expansion of the thorax, succeeds an entire perfect expiration. It is *small*, when the dilatation is scarcely sensible.

We thus see that the respiration is not large when the thorax remains expanded, the inspiration not being followed by a full expiration. So in peripneumony, the respiration is frequent, quick, and small, although the chest is completely expanded ; this is called a *high respiration*.

The large and rare respiration constitutes the sublime ; it rarely accompanies affections of the air passages ; it is more usual in cerebral fevers, on the approach of phrenitic delirium.

The smallness of the respiration is more usually indicative of thoracic affection, or lesion of the thoracic parenchyma.

M. Landre Beauvais has called that respiration *great* or large, in which much air is inspired, and that *small* in which little is taken in. As I examine the respiration in relation to the movements of the chest, I have considered it necessary to give the same name to a different phenomenon, but one which frequently coexists with that noted by this learned professor.

5th. Respiration is *equal*, when inspiration, whether great or small, quick or slow, is followed by a similar expiration; *unequal*, when one or other of these movements is stronger or more prolonged. Adynamic and ataxic fevers, most spasmodic affections and asthmas, offer examples of it. This inequality is a constant symptom of pleurisy and acute pneumonia. When the pleura is inflamed, inspiration is quick; expiration, although short, appears long as compared to inspiration; the seat of the pain in this complaint easily accounts for this phenomenon.

When the phlegmacy occupies the lung, it is the expiration, on the contrary, which presents this brevity, the affected organ being by this painfully compressed: in this case the thorax seems always raised.

The high respiration, which we have already said to be a symptom of this affection, depends on the difficulty of expiration.

6th. Respiration is said to be *easy*, when the muscles destined to produce expiration (inspiration?) are sufficient, and execute this movement without difficulty; it is *difficult*, when the large accessory muscles are called into action, or, when the properly inspiratory muscles contract with violence, or as if convulsively. Simply inspecting the neck, enables us to recognize this difficulty of respiration; the hard projecting *scaleni*, impress shocks on the lateral parts of the neck, easily distinguished. The *intercostals* exhibit the same in thin persons. This state has different degrees: thus the respiration may be simply difficult or laborious, or it may be suffocating.

In the last case, the patient threatened with suffocation cannot keep the horizontal

posture; sitting and bending forwards, he forcibly presses his head upon his raised knees, seeking a firm support for the hands, and thus fixing the upper extremities, forcibly contracts the muscles of respiration, of which every effort is concentrated on the thorax to dilate it fully.

To this variety of respiration the name of *orthopnæa* has been given; it is common in paroxysms of asthma, and becomes sometimes habitual in persons affected with emphysema of the lungs. The convulsive respiration, a common symptom in the different diseases comprehended under the term asthma, may be referred to difficult respiration. M. Pascali has lately communicated to the Academy of Medicine observations upon the employment and utility of galvanism in those cases. It would appear from his experiments, that this convulsive state of the respiration, depends rather on an alteration of the vital powers of the nervous system, distributed to the muscles of the thorax, than on that of the lung itself.

The chief part of the thoracic and a great number of abdominal diseases, render the

respiration difficult. Thus every obstacle to the entrance of air into the lung, or to the dilatation of the thorax, whether existing in the cavity or not, may induce difficulty of respiration.

7th. I call that respiration *complete* in which the lungs of both sides concur equally ; it is characterized by equality of force and extent in the movements of the thorax. I call that *incomplete*, in which one side remains wholly or in part immoveable, or moves less than the opposite one.

This sign is among the most certain and constant of all those furnished by the examination of the movements ; it belongs almost exclusively to diseases of the organs of this cavity : it is sometimes sufficient to point out pleurisy or peripneumony in infants ; it will enable us in all cases to dispense with the tedious questions, and fatiguing and useless researches, by pointing out the seat of the disease.

It depends at one time on a phlegmacy of the lungs, at another on an effusion ; a simple pleurodyne may also produce it. It is not rare to meet individuals who present it al-

though enjoining perfect health, but it is then the result of preceding disease, which has produced numerous and close adhesions between the coats of the pleura. It may depend perhaps as much on the tissue of the lung being impermeable to the air, as on those adhesions.

8th. We have mentioned that variety of respiration, of which the term *abdominal* alone gives an idea. The belly rises in inspiration, sinks in expiration, and the ribs execute no movement.

This phenomenon is observed when both sides of the lungs are become unfitted for respiration; it is among the worst symptoms, and is usually a forerunner of death. However, the respiration becomes naturally abdominal in very old persons, owing to the ossification of the cartilages of the ribs, which opposes the action of their muscles, already weakened by age.

9th. *Thoracic* respiration, effected by the elevation of the ribs, without the assistance of the diaphragm, is observed in all cases of intense extensive inflammation of the abdominal organs, or when this cavity is distended by the produce of conception, or other accidental production.

Such are the changes that take place in the movements of the thorax in relation to their rhythm, their extent, facility, and simultaneousness.

The other modifications of the respiration relate to the qualities of the air expired, or to the noise it produces, either in entering the thorax, or escaping from it. We shall speak of them elsewhere.

CHAP. II.

Of Percussion.

SECTION I.

THIS mode of investigation, proposed by Avenbrugger, and brought to perfection by Corvisart, was for a long time the only one in practice, and with experienced practitioners contributed much to the certainty of diagnosis in diseases of the chest. Since the discovery of auscultation, it has lost none of its advantages; and it would be an error to suppose that the assistance of the stethoscope renders its use unnecessary.

The cavity of the thorax, which in the healthy state is almost entirely filled by the lungs, and always more or less distended by air, returns a sound when struck, very similar to that of an empty barrel. (This comparison, though inexact, is the most correct

I have been able to find.) The word *percussion* has been applied to the means employed to ascertain the nature of this sound.

The sound returned by the chest when struck upon, is always proportioned to the capacity of this cavity, and to the thickness and elasticity of its walls, but has not the same character at all points. It varies, 1st, According as the part is covered by thick and fleshy integuments ; 2d, According to the degree of leanness, of fatness, or of infiltration* of the subject ; 3d, According to the posture of the patient ; 4th, According to the manner in which percussion is practised.

All these varieties should be well known in a healthy subject, to enable us to appreciate the changes arising from disease.

1st. *According to the Points of the Chest struck upon.* A clear sound is obtained whenever we strike upon a bony part covered by the skin only, or by thin muscles sufficiently stretched to transmit the shock wholly, without absorbing any of the sound. The most

* The anasarious state of the integuments of the chest.

favorable parts are, anteriorly, the clavicles, when they are not too much elevated and raised from the thorax ; the space lying two or three inches below them ; all the surface of the sternum, and the parts nearest the cartilages of the ribs.

In the remaining anterior part of the thorax, the mamma in females, the fat which covers over the middle and inferior part of the pectoralis major in many men, the vicinity of the liver on the right, and of the heart on the left, diminish the sonorousness natural to the thorax.

Upon the sides we may strike with advantage, in the hollow of the axilla, and three inches below it ; but from the fourth and sometimes the third rib downwards, the sound is always less clear on the right, owing to the neighborhood of the liver ; while on the left, it is often louder than it ought to be from the proximity of the stomach, particularly when that viscus is much distended by air ; the resonance then becomes something metallic.

Behind, the most distinct sound is perceived along the costal angles. In thin persons we may percuss usefully on the supra and infraspinal hollows of the scapulæ, and upon

the spine of that bone, but we cause no sound in striking upon the fleshy layer of muscles which fills up the vertebral hollows.

2d. *According to the Leanness, Fatness, or Infiltration of the Subject.* It is evident that, all other things being equal, the chest will be more sonorous in thin subjects than in those overburdened with fat, and that it will return no sound in patients the parietes of whose thorax are anasarcaous.

3d. *According to the Posture of the Patient.* The more the thorax is separated from all around, the less will the sound be altered; we should not then percuss when the chest is covered with clothes, or sunk in a soft bed or pillows.

When we examine the anterior part, the patient should be seated with his arms carried backwards. He should raise them above his head when his sides are examined, and cross them over his breast, at the same time arching his back, while we examine that part. These different positions stretch the muscles which cover the thorax. It is not always possible to place patients in those positions: when such is the case we make them lie flat

upon the back, and raise the arms over the head, while we examine the lateral and anterior parts of the thorax; but the results thus obtained are always less striking and less certain. According to M. Lænnec, the smallness of the alcove, and the narrowness of the chamber, alter the quality of the sound.

4th. *According to the mode of performing Percussion.* This operation, apparently so simple, requires a number of precautions to be truly useful. We shall point out the best manner of proceeding.

We should close and bring together all the ends of the fingers half bent, or we should form them upon the same line, so that one may not project beyond the other. We should then strike with an equal and moderate force upon similar parts, in the same direction and extent, making the ends of the fingers fall perpendicularly to the plane upon which we strike.

Too strong percussion would be painful; an unequal one would give an unsatisfactory result. It would be the same if we struck dissimilar parts, as a rib and an intercostal

space ; if the fingers inclined perpendicularly on the right, obliquely on the left side ; on a space double or triple the extent on one side to the other, since each of these variations must necessarily modify the sound. It is also necessary not to examine all the points of one side before passing to the other, because we thus lose the remembrance of the results obtained in corresponding points ; it is better to strike first on one side, and then on the other.

To fulfil all these conditions, none of which are superfluous, we must strike as much as possible with the same hand, and place it in the same direction relatively to the part struck.

Percussion with the hand extended has sometimes advantages, whether we wish to know the sound of a great part of the thorax, or to ascertain that the walls of this cavity are too thick to answer otherwise. But we must not let the air confined between the hand and the thorax, produce a sound capable of masking that of the thorax itself. Further, we should leave the hand applied to the thorax to feel if the trembling motion resulting from the elasticity of the lungs ex-

ists, or has ceased to be produced. Slight blows with a stethoscope, or other solid body of convenient form, are often the best means of producing appreciable sounds.*

SECTION II.

In the state of disease, the sound returned by the thorax is often altered. These alterations are four in number. The sound may be *dull, obscure, absent, or more clear than natural*. The names point out the nature of these alterations; it remains only to explain their causes.

* A new method of percussion has lately been proposed by M. PRIORRÉ, which consists in making the percussion upon a circular piece of wood or ivory, a line in thickness and an inch and a half in diameter, with a small handle to keep it in its place. The advantages of this method are said to be, that by it we obtain a louder sound, inasmuch as the operation may be performed through the clothes; that we can employ a greater force, and employ a more sonorous body than the fingers; that we can select more accurately the point to be percussed, and protect the parts better from the effects of the blow.

Some persons use the stethoscope as a hammer in making percussion; but it is ill adapted for this use, and is apt to bruise the parts struck.

Every time the lung loses its elasticity and becomes engorged, without however becoming totally impermeable, the sound becomes dull or obscure, according as the engorging of the pulmonary tissue is more or less considerable. Thus then an intense catarrh*, the first degree of pneumonia, an œdema of the lung, produce this alteration.

The sound becomes wanting in two cases ; 1st. When the lung loses its permeability completely, its tissue becoming dense, like the substance of the liver, in consequence of an abundant exhalation of blood into its areolæ, and of the combination of this liquid with its tissue. 2d. When it is compressed, thrust back by some accidental production, developed in its thickness, or in the cavity of the pleura, or when this cavity is filled by some fluid.

In either case, a greater or less part of the side affected may be yet sonorous, according as the hepatization, the accidental tumor, or the effusion, are more or less considerable. Finally, the sound will acquire a greater in-

* Catarrh has the same meaning in France, as Bronchitis in England.—Transl.

tensity than in the natural state, when the pulmonary tissue becomes as it were rarefied, or when the cavity of the pleura is occupied by air, or other gaseous body.

If I have not spoken of percussion upon the precordial region, in cases of disease of the heart, it is because it is rare to meet cases of hypertrophy considerable enough to determine perfect dulness of sound ; and that in cases where the sound is simply obscure, we can conclude nothing from it, from inability to establish a comparison between this part and that of the opposite side. This remark is correct, if we have yet had no opportunity of seeing and percussing the patient ; but if we can compare his present with his former state, and thence observe some difference in sonorousness percussion then offers valuable signs, very useful in the diagnosis.

The signs furnished by percussion are of great importance ; we must not however depend on them always ; it may happen that the sonorousness of the chest may be altered by causes foreign to the organs of the cavity. Thus every large tumor in the abdomen, pregnancy, ascites, diminish the sonorousness,

and contract the thoracic cavity, thrusting up the lungs; but no cause, entirely independent of the pectoral organs, can produce a complete loss of sound.

CHAP. III.

Of Auscultation.

THE word auscultation is applied to the examination, by means of the ear, of the different sounds produced in the interior of the thoracic cavity, by the circulation of the air, the resounding of the voice, or the palpitation of the heart. It is either *mediate* or *immediate*.

Immediate auscultation, is that in which the ear is applied naked to the different points of the chest. Inconvenient and disagreeable to the patient, it is besides far from giving the results that it seems to promise. The sounds it yields, have never a perfect clearness; transmitted through the whole surface of the head, which is in contact with the breast, they have too much force to allow us to appreciate justly their shades, and they are all so confounded, that it is difficult to

distinguish the parts from which they proceed.

It is difficult, besides, for the head to follow the different movements of rising and falling of the chest; and the friction of the clothes adds still to confusion.

In fine, although it may be good in some cases, it is not applicable to all; the ear cannot be placed upon all parts of the thorax, particularly in women, with whom decency alone would suffice to prohibit this mode.

The inconveniences which have prevented us from having recourse to this method, and which have retarded the discovery of a means, simple and easy in its execution, and which M. Lænnec has demonstrated to be so fruitful in the results, so advantageous, I may say so necessary in the practice of physic, are without doubt numerous.

If this learned professor was indebted to a happy chance for his first ideas of it, he soon recognised the immense advantages this means might procure; he anticipated its importance, its utility. To invent an instrument, proceed to a long series of researches, collect numerous observations in minute de-

tail, verify by inspections the diagnosis formed at the patient's bed-side, arrange facts, seek the most probable explanation of the phenomena daily presenting themselves, publish a work to which the repeated experiments of the numerous partisans of his method can scarcely add a few pages,—was to him a labor of only three years.

I shall not here describe the stethoscope ; * it is too well known to require a particular detail. It is sufficient to say, that M. Lænnec has determined by numerous experiments, that the cylindric form is best ; that it is necessary to make use of wood, neither too light nor too dense, in the formation of the cylinder ; that it should be a foot long, fifteen lines in diameter, and its canal three lines ; that one of its ends should be hollowed out in a conical form, and have a stopper adapted to it to be used when necessary.

To make use of the stethoscope, it should be held as a writing pen, the ends of the fingers closed upon the instrument, so as to feel

* From *στήθος* *pectus* and *σκοπέω* *specular*, the *chest-inspector*.—Ed.

at once the end of the cylinder and the point of the chest upon which it is rested ; the end of the instrument should be placed flat upon this part, so that it may be perfectly perpendicular ; and where excessive emaciation renders the intercostal spaces hollow and the ribs projecting, the concavity should be filled up by charpee *, or other soft substance †.

The ear should rest more or less forcibly upon the other end of the instrument ; use will teach the cases in which it is to be applied lightly, and those requiring a certain degree of pressure.

We must remove some of the patient's clothing if the part be too thickly covered, or if the clothes be made of wool or silk, or other stuffs capable of causing a sound resembling those heard with the cylinder. In the examination of the respiration in particular, we must not judge from the first moments of the investigation ; the buzzing arising from

* Charpee, linen separated into threads, instead of being scraped into lint, as with us. It is used for the same purposes as lint.

† Cotton wool is a good and convenient material for this purpose.

the application of the instrument ; the fear, the constraint, the embarrassment of the patient ; the palpitations of the heart, render the sounds obscure, and hinder us from distinguishing them accurately.

In exploring the palpitations of the heart, and the phenomena produced by the voice, the cylinder is to be used with the stopper in ; but without it, when we wish to hear the noise of respiration, or the sounds of which the heart is sometimes the seat. It may be applied with the same facility upon all parts of the chest. The phenomena this examination makes known, are natural or pathologic. The natural phenomena are those which exist in the sound state of the organs ; they must be studied first, in order not to confound them with those produced by disease, and to enable us to note their absence and appreciate clearly their alterations.

SECTION I.

Natural Phenomena.

These differ according as they are produced by the respiration, the voice, or the heart.

They form therefore three classes, each of which shall be the object of a separate article.

ART. I.—*Natural Phenomena furnished by the Respiration.*

They offer some variety : 1st, According to the points examined ; 2d, The frequency of the respiration ; 3d, The age, sex and particular disposition of the individuals examined.

1st. *According to the points examined.* On applying the cylinder to the thorax of a healthy man, we hear, at every inspiration and expiration, a gentle but very distinct noise, which indicates the penetration of the air into the pulmonary tissue, and its expulsion from it. It may also be perceived clearly that the air is received into a series of very small cavities, which expand to admit it, and not into one large extensive cavity.

This murmur is nearly equally strong in all points of the chest, but most so in those at which the lung is nearest to the surface of the skin, that is, at the superior lateral and the posterior inferior parts. The hollow of the axilla, and the space between the clavicle and edge of the trapezius, are the points where it has most intensity.

Upon the trachea, larynx, and root of the lungs, the respiratory murmur is heard perfectly, but it has a particular character, which gives an idea of the air passing into a larger passage than that of the air cells. Neither do we distinguish the expanding of the pulmonary tissue, and the air seems to be attracted from the cylinder in inspiration and repelled in expiration. We may compare this mode of respiration, which we shall call tracheal, to the blast of a bellows*.

* *Bronchial respiration* (*Bruit respiratoire bronchique*) is the term by which M. LÄENNEC designates the sound of the respiration as heard in the larynx, trachea, and larger bronchial trunks.—Vide *Läennec*, last edition, p. 55; *Forbes*, p. 32.

When the texture of the lungs becomes indurated from any cause, such as a pleuritic effusion or the changes occasioned by a severe peripneumony or hæmoptysis, the vesicular respiration having then disappeared, or being much lessened, we can frequently perceive distinctly the bronchial respiration, not only in the large but even in the small ramifications of the bronchia.

It is of great consequence to accustom ourselves to distinguish accurately the bronchial from the vesicular or pulmonary respiration, not only on account of the great errors of diagnosis, which must result from

2d. *According to the frequency.* The more frequent the respiratory murmur is, the noisier does it seem. A deep, slowly drawn inspiration, is sometimes scarcely heard : we should therefore recommend that persons being examined should breathe somewhat quickly.

3d. *According to the age, sex, &c.* In children, women, and men of a nervous constitution, the respiration is sonorous and noisy ; the development of the cells is more easily appreciable, giving an idea of their being of a greater size or of dilating more. This difference of noise exists chiefly in inspiration ; it is less distinct in expiration ; the younger the child is, the more it is marked ; it continues usually till puberty, or rather beyond it.

In adults the intensity of the noise varies much ; there are some very healthy persons

their being confounded, but because the former becomes a pathognomic sign in several cases of importance. In peripneumony it is one of the first indications of hepatization, and commonly precedes the loss of the natural sound on percussion : it is likewise one of the earliest signs of an accumulation of tubercles in the upper lobes of the lungs.

in whom it is scarcely heard unless they draw a full inspiration; these ordinarily have their respiration frequent. In others it is strong enough without their being at all short-breathed. In fine, some persons preserve a respiration similar to that of children, even to old age, and seem in the same degree more disposed to diseases of the respiratory organs.

ART. II.—*Natural Phenomena furnished by the Voice.*

The natural phenomena furnished by the voice, vary: 1st, According to the points examined; 2d, According to the tone of the voice. When a healthy man speaks or sings, his voice resounds in the interior of the chest, and produces through the whole extent of this cavity, a sort of tremor, easily distinguished on applying the hand. We shall not occupy ourselves with this tremor; it is a phenomenon of moderate importance, of which we rarely find occasion to take advantage. However, where a vast excavation exists, this tremor acquires such a force that it alone may make us suspect it.

1st. *According to the points.* On applying

the cylinder upon the thorax, a confused resonance of the voice is heard ; its intensity is not the same at all points.

The parts where it is strongest, at the axilla, the back between the inner edge of the scapula and the vertebral column, the anterior superior part of the chest, towards the angle formed by the junction of the sternum and clavicle.

At those spots the voice seems stronger and nearer to the observer than with the naked ear ; in other parts, more particularly below and behind, it seems weaker and more distant, and produces a confused sound, in which nothing articulate can be distinguished.

2d. *According to the tone.* In men who have a deep-toned voice, this resonance is stronger but flat, confused, and nearly equal at all points; it is clear and very distinct in persons whose voice has a sharp tone, in women and children. Finally, the agitated and trembling voice transmits the resonance very weakly, and in cases of aphonia is wholly absent.

ART. III.—*Natural Phenomena furnished by the Heart.*

These may be divided into four classes, and comprehend; 1st, The extent of the heart's pulsations; 2d, The shock which they communicate; 3d, The noise which accompanies them; 4th, Their Rhythm.

1st. *Extent of the palpitation of the heart.*

In a healthy man of a moderate degree of plumpness, whose heart is of regular proportions, the beating of the heart can only be felt in the precordial region, that is to say, the space comprised between the fifth and seventh sternal ribs on the left side, and under the lower part of the sternum. The motions of the left cavities are felt in the first point, those of the right cavities in the second. When the sternum is short, the pulsations are still sensible in the epigastrium.

In very fat persons, the pulsations of whose heart cannot be felt by the hand, the space in which they can be detected by the aid of the cylinder, is sometimes limited to a surface of about a square inch. Very thin persons, with narrow chests, offer the opposite dispo-

sition; the pulsations of the heart have more extent, and may be felt in the third or even three-fourths of the inferior part of the sternum, sometimes under the whole of this bone, in the left superior part of the chest as far as the clavicle, and even beneath the right clavicle. When the extent of the pulsation is limited to the points just mentioned, in persons such as we have pointed out, and they are less sensible under the clavicles than in the precordial region, the heart is still in good proportion.

2d. *The Shock.* I understand by shock the sensation of impulse or percussion against the ear of the observer, arising from the pulsations of the heart. It is distinct with the cylinder when the hand applied upon the region of the heart can perceive nothing. This shock is very inconsiderable in a healthy man, particularly if tolerably plump. It is felt most in the precordial region and lower half of the sternum, and always with most force between the cartilages of the fifth and sixth ribs, the part corresponding to the point of the heart. Its force varies greatly, according to the constitution of the individual;

it is therefore difficult to refer it to a uniform type. Practice teaches us to distinguish whether it be more or less intense than it ought to be; it should be rather less for the right ventricle than for the left.

3d. *The Noise.* The alternate contractions of the different parts of the heart return a sound insensible in the healthy state, but easily perceivable by the cylinder, however small may be the strength or volume of the organ.

In the natural state this sound is double, and each pulsation of the heart corresponds to two successive sounds.

One clear, abrupt, analogous to the sound of the clapper of the bellows, corresponds to the systole of the auricles; the other more flat and prolonged, coincides with arterial pulsation, as well as with the sensation of the shock mentioned in the preceding article; it is produced by the contraction of the ventricles.

The noise of the right cavities is heard at the lower part of the sternum; that of the left cavities between the cartilages of the ribs. It is always stronger in the precordial

region than in the other points of the chest, where it may become developed in persons, who, though otherwise healthy, have a heart with very thin walls. We observe also in them, that the sound of the auricles is more sonorous under the clavicles than that of the ventricles, which does not exist in the precordial region. In persons in whom the pleura and anterior border of the lungs is prolonged before the pericardium, the noise of the auricle is duller and more obtuse than that of the ventricles, without ceasing to be distinct. That depends without doubt on its being masked by the murmur of respiration, or by that produced by the air pressed out from this portion of the lung, by the heart's pulsation.

4th. *Rhythm.* We understand by the term Rhythm, the order of the contractions of the different parts of the heart, as they are heard by the cylinder, their respective duration, their succession, and general relation to each other. In a healthy man, whose heart is in a state favorable to the performance of all its functions, at the moment in which the artery strikes the finger, the ear applied upon the cylinder is gently raised by a movement

of the heart, isochronous to that of the artery, and accompanied with rather a dull sound ; it is the contraction of the ventricle. Immediately after, and without any interval, a shorter, louder sound announces the contraction of the auricle ; no movement sensible to the ear accompanies this sound. An interval of repose succeeds to it. This interval, although short, is well marked. After it a new complete contraction of the heart is perceived.

The respective duration of the contraction of the auricles and ventricles appears determined with sufficient precision as follows. Of the total period taken up by a complete contraction and repose of the heart, a third to a fourth is occupied by the systole of the auricles ; rather less than a fourth by the absolute repose ; the rest by the contraction of the ventricles. These relations exist, whatever be the swiftness or slowness, the frequency or rarity of the movements, when the organ is healthy and well proportioned.

SECTION II.

Pathologic Phenomena.

By pathologic phenomena, we mean the modifications of the natural phenomena produced by some lesion of the organ in which they are observed. We shall refer them to four principal divisions. Phenomena furnished, 1st, By the respiration; 2d, By the voice; 3d, By the respiration and the voice; and, 4th, By the heart.

ART. I.—*Phenomena furnished by the respiration.*

The respiration may be stronger than in the natural state; it may be more feeble, wholly absent, or it may be analogous to that variety we have called *tracheal*. It may be pure, or combined with different kinds of rattle.

When the respiration becomes stronger than in the natural state, it assumes the character of that observed in infants, and has, for that reason, been named by M. Läen-

nec, *puerile respiration*. This increased intensity of the respiratory murmur is never observed in cases of lesion of the lung, or of a part of the lung. It is met only in the healthy parts of the lung, the action of which is temporarily increased to supply the loss of the part diseased. Thus in pneumonia, it is not uncommon to find the respiration puerile in the parts not affected by the disease. However, we see this exaggeration of respiration coincide with a great dyspnœa, in some cases of asthma and of hysteric suffocation: it is difficult to account for this anomaly. We have thrice observed the respiration stronger than in the healthy state, in parts which have been attacked with pneumonia on the following day. This respiration was not truly puerile; it seemed to occur in a vast cavity immediately below the cylinder nearer to the surface of the body than it does in the thinnest persons.

In those three cases the peripneumony perhaps already occupied the centre of the organ, and the air vessels nearest to the surface alone were fit for carrying on respiration.

The respiratory murmur offering numerous varieties in the healthy state, it is only by

examining different parts of the pulmonary organs that we can judge of its diminution. This comparison is always easy, for it is rare to find the respiration weakened in a whole lung, or in both together. The intensity of the noise offers many degrees, from a slight diminution to the most complete absence. The small extent of the movements of the thorax seems most commonly to be the cause of this diminution: it often depends also on the incomplete obstruction of the bronchial tubes of the middle size, owing to swelling of their lining membrane, or to the presence of accumulated sputa. We find it also in cases of membranes continuing soft, and only beginning to be organized.

The absence of the respiratory murmur may proceed from many causes. It occurs when the lung is become impermeable to the air, or when a liquid is interposed between it and the thoracic walls, or any other body accidentally developed, which prevents the transmission of the sound. It is rarely observed in the whole extent of one side of the thorax. The clavicles and the root of the lungs are the points where it occurs most

rarely ; perhaps never in the latter of these parts.

The tracheal respiration, of which we have spoken in treating of the natural phenomena, is sometimes observed in other points than those in which it is perceived in the healthy state. It cannot take place unless there be formed in the lung an excavation of considerable size, communicating freely with the bronchia, or being continuous with them. It has seemed to me also to arise from a hardening of the hepatized pulmonary tissue, which transmits to the ear the motion of the air in the great bronchial pipes, more noisy from the impossibility which the induration offers to the penetration of the air into the bronchial vesicles. Whatever be the intensity of the respiratory murmur, it may be either pure, which indicates that the bronchia are perfectly free, or it may be attended with rattles.

We understand by the term *rattle** every

* The term *râle*, which is here translated rattle, was adopted by Laënnec to express the rattling, or wheezing noise described above. The Latin word *Bhoricus*, (gr. *ρορχος*) was afterwards substituted by Laënnec

kind of noise attending the circulation of air in the bronchia and vesicles, different from the murmur produced by it in the healthy state.

The rattles rarely occupy all the extent of the organ; most commonly they are perceptible only in an inconsiderable extent, and the respiration remains natural, or even becomes puerile in the rest. They announce either the contraction of some part of the bronchial tubes, or their being gorged by some fluid, or finally, a similar state of the air vesicles.

Their difference, their remoteness or closeness, and the extent that they occupy, will point out tolerably well the place where these liquids exist, and most of their physical properties. At a small distance from the spot occupied by any lesion of the lungs, the rattle characterizing it ceases to be heard, and the respiration may be natural, although in the vicinity of a part very deeply affected. We shall distinguish four principal kinds of rattle:--

himself, and being taken from a language not in common use, will better retain its precise and technical meaning.—*Ed.*

1st, The *dry sonorous* rattle; 2d, The *hissing*; 3d, The *mucous*; 4th, The *crepitating*. Among these the greatest number are best heard during the act of respiration, others during the act of coughing. Each kind may exist alone, or combined with two or three others, either in the same point, or at different points. Some are permanent during the whole duration of the disease, which they serve to characterize; others are as it were intermittent, appearing and disappearing by turns, occupying at one moment one spot, soon after another; so that they may be absent at one moment in a part where they had been heard the instant before.

The sonorous rattle.—This consists in a sound more or less grave, and often extremely noisy, resembling at one time the snoring of a sleeping man, at another the sound produced by rubbing the string of a bass viol with the finger, and frequently the cooing of a dove. It appears to be owing to the contraction of the bronchial tubes by the swelling of their lining membrane, or to some change in the form of these canals, perhaps to the thickening of the spurseperons at the point of

division of the bronchia, a thickening we almost constantly observe in subjects who have fallen during the continuance of a catarrh, either acute or chronic

The sibilant or hissing rattle.—It resembles a prolonged hiss, and accompanies either the end or commencement of inspiration, or of expiration. It is grave or acute, dull or sonorous. These two varieties are sometimes met together in different parts of the lung, or succeed each other in the same point, at closer or more distant intervals. It depends on the presence of mucosity, not very abundant, but thin, viscous, obstructing more or less completely the small bronchial ramifications which the air must traverse to reach the air vesicles. It seems to me to indicate an alteration of the lung, deeper than the preceding, that is to say, occupying finer ramifications; and when it is heard in a great part of the organ it is attended with more constraint of respiration. It is during the existence of the sibilant rattle that we observe those mucous sputa of an arborescent appearance, presenting to the eye the form, calibre, and ramifications of the small tubes from

which they have been propelled by the effort of coughing.

The mucous rattle.—This rattle, produced by the passage of the air through sputa accumulated in the bronchia or trachea, or through softer tuberculous matter, denotes by its nature the unctuous untenacious state of the liquid which fills the air tubes. At one time it is weak, and produced at remote intervals; at another it is strong and persistent. In the first case it may be judged that the column of air meets only at intervals the mucosity which produces it; in the second, that the bronchia are almost entirely filled with it. Carried to the highest degree it constitutes gurgling, the name by which we characterize the noisy murmur caused by the agitation of tuberculous matter, or purulent sputa, with the air traversing them.

Crepitating rattle.—This consists in a noise which may be justly compared to that of butter boiling, or of salt crackling on a hot bassine plate, or to that produced by squeezing a bit of dried healthy lung between the fingers. It seems to be owing to the exhalation of blood into the air cells, observed in a

lung affected with the first degree of pneumonia, of which the crepitating rattle is the pathognomonic sign. A new proof of the reality of this cause may be drawn from an analogous kind of injury in œdema of the lung, characterized by a variety of this rattle of which I am about to make mention. This variety has very striking characters; and if we have not made a particular species of it, it is because it is difficult to describe its differences exactly, though they are very sensible to the ear; and it is enough to have heard the two kinds once, not to confound them afterwards. The name of subcrepitating, given to it by M. Lænnec, indicates its character well. In reality, this rattle is analogous enough to the first, but it gives a sensation to the ear that the liquid which produces it has more tenuity and less plasticity than the crepitating rattle. On opening the dead bodies of subjects affected with œdema of the lungs, we find this viscus filled with a limpid serous fluid without viscosity which fills up the bronchia and vesicles, and is filtrated into the interlobular cellular tissue, rendering the lung flaccid and inelastic.

Such are the different rattles audible with the cylinder. We see by their description that they cannot be mistaken, and each offers very striking characters; but their differences are often less sensible, and shades, which practice teaches us to seize, and which words cannot express, establish a sort of transition between each of them, and indicate a mixed lesion, more or less like that indicated by each individually.

ART. II.—*Phenomena furnished by the Voice.*

The phenomena presented by the voice are of three sorts; Resonance, Pectoriloquy, and Hægophony.

*Resonance**. I understand by resonance, a more than naturally sonorous resounding of the voice, existing in a part in which it cannot be perceived in the healthy state.

Resonance offers no articulated sound; it seems but a confused noise, scarcely approach-

* Resonance is often mistaken by beginners for pectoriloquy, though the directions given in the text ought to prevent the mistake. It often exists for a long time below the clavicle, before the formation of a cavity gives rise to pectoriloquy.

ing the extremity of the tube of the cylinder below which it takes place, and never appearing to enter the canal so as to reach the ear of the observer.

The hardness of the pulmonary tissue, its compactness, produced either by a mass of unripe tubercles, or by inflammatory action, seems to me to be the cause of this want of articulation, by rendering the lung more fitted to transmit the murmur of the voice from the bronchia. This symptom, usually of little importance, sometimes acquires considerable value, by comparing the two sides of the chest, and from its coexistence with other modes of research*.

* *Bronchophony*. (*Bronchophonie*. LÄENNEC, vol. i. p. 64. *Bronchophonism*, FORBES, p. 36.)

In persons of a delicate frame, particularly in lean children, there frequently exists in the situation of the bronchia, a *bronchophony* very similar to *laryngophony*.

The sound of the voice is scarcely at all perceptible in the bronchia distributed through the lungs, when these organs are healthy; but in disease of the voice may become perceptible in the smaller bronchial tubes. Thus it is found that an attack of peripneumony, an extensive hæmoptysical induration, or the accumulation of a great number of tubercles in the same point,

*Pectoriloquy**. This is said to be present when the patient's voice, distinctly articulated, seems to proceed from the point of the chest on which the instrument is placed, and to pass through the tube of the instrument to the observer's ear.

It is *perfect*, *imperfect*, or *doubtful*. Perfect pectoriloquy is that which presents all the characters we have just mentioned, that is, in which the voice, clear and well articulated, traverses the cylinder and arrives at the ear of the observer either with its natural tone, or with a stronger one. It is imperfect, when

by condensing the texture of the lungs, gives rise to a sound analogous to pectoriloquy. This accidental bronchophony is most marked when the pulmonary induration takes place near the root of the lungs. This sign is one of the best to measure the progress of a recent peripneumony.

The dilatation of the bronchia, or the accumulation of tubercles, separately or combined, may give rise to the same phenomenon. Bronchophony is rarely so like pectoriloquy as to deceive a person even of moderate experience.

* Whenever we are doubtful of pectoriloquy, it is a good plan to compare it with the sound produced by applying the cylinder upon the trachea while the patient is speaking.

the articulated voice resounds with force under the cylinder, and appears closer to the ear without entering the tube completely. Finally, it is doubtful, when, as with ventriloquists, the voice seems sharp and unnatural, and does not traverse the tube; it is little more than resonance. Imperfect and doubtful pectoriloquy only deserve attention when they exist but at one side, or are joined to other signs drawn from examination of the respiration.

The most perfect pectoriloquy may sometimes assume the characters of the imperfect or doubtful kind; it may also disappear from time to time, or become as it were intermittent: we will state in what circumstances, after having explained the causes of pectoriloquy.

This phenomenon is always owing to the presence of excavations in the lung, communicating freely with the bronchia, and wholly or partly empty. It may be met with in all points of the chest; but the parts in which it is observed the most frequently, are, below the clavicles, in the hollow of the axilla, the space between the clavicle and the trapezius

muscle, the supra and infra spinal fossa. These parts all correspond to the summit of the organ, and it is in that part in reality, that excavations, produced by the softening of tubercles, are most frequently detected.

Pectoriloquy offers some variety, arising from difference in the tone of the voice, the size of the cavity, its form, the firmness or softness of its walls, their adhesion or want of adhesion to the costal pleura, or to the difficulty with which the air penetrates them.

1. The more acute the voice is, the more evident is the pectoriloquy; it is almost always imperfect and sometimes doubtful in persons of a deep-toned voice. Aphonia does not make it disappear completely; and it often happens in these cases, that we can distinguish what the patient says, better with the cylinder applied to the point of the chest where the cavity exists, than with the naked ear at the same distance.

2. Perfect pectoriloquy requires the cavity to be of moderate extent. In very large cavities it changes to a stronger, deeper sound, analogous to that of the voice transmitted to some distance through a scroll or trumpet

made of paper. In very small caverns it is often doubtful, particularly when the excavation is central, and surrounded with parts of the lung still permeable to the air.

3. The winding disposition of the cavities, or the direct communication of a number of excavations with one another, give something of a confused or stifled sound to the pectoriloquy; the voice seems badly articulated.

4. The firmer and thinner the walls, the more perfect the pectoriloquy. When cicatrization has produced a membrane of a fibro-cartilaginous nature over the whole surface of one of the cavities, pectoriloquy acquires a metallic tone, sometimes so noisy as to injure the clearness of the perception of the sounds.

5. An excavation placed near the surface of the lung, the thin wall of which does not adhere to the costal pleura and sinks in expiration, does not yield pectoriloquy; we then recognize its existence by other characters. On the other hand, a superficial excavation with thin adherent walls, gives a striking pectoriloquy with a force which fatigues the ear.

6. The less fluid there is in the excavation, the more evident is the pectoriloquy, because the communication with the bronchia is then usually large, and permits a free access to the air. However, this communication may be destroyed more or less completely, and for a longer or shorter time, by the stagnation of the sputa in the bronchial tubes; it is this which sometimes renders pectoriloquy doubtful, and gives it that intermittent character not rarely observed. There are days in which we can hardly find one case of it in a ward in which the day before we observed a great many: we perceive then that in most cases the expectoration has been but small, or wholly deficient.

Pectoriloquy is produced by the voice resounding in those excavations. However, I am about to state facts which prove, that, although pectoriloquy is the pathognomonic sign of the existence of an accidental cavity of the lung, it may be produced without that alteration existing, in circumstances proper for increasing the natural resonance of the voice in the bronchia, or at least that a phe-

nomenon then manifests itself, almost perfectly resembling pectoriloquy.

Six patients were brought into the hospital "*Neckar*" at not very distant periods; they were affected with pneumonia occupying the upper lobe of one of the lungs. All presented evident pectoriloquy at the upper part of the chest, from the change of the first to the second stage, and during the whole duration of the latter. Two died; the first during the acute stage of the disease. On inspection we found a single very small abscess, situated in the centre of the summit of the organ, and which seemed to me entirely filled with pus, and consequently without communication with the bronchia; the rest of the lobe was hepatized and very dense. The second succumbed after some months of disease, in which he presented most of the symptoms of the third degree of pulmonary phthisis. He had been pectoriloquous in a high degree, and expectorated a large quantity of suspicious looking sputa. In him the summit of the lung was found hollowed out with a number of vast cavities, communicating freely with each other, and covered

over by a thin pseudo membrane firm enough to be divided into layers. (The disease had lasted three months.) The rest of the lobe was in a state of grey hepatization, and had acquired a remarkable density. No tubercles were found in any viscera, nor in the hardened portion. The other four patients, who were cured in a tolerably short period, ceased to be pectoriloquous before leaving the hospital, and, in proportion as the respiration returned, the lung recovering its permeability, the phenomena diminished in them. During the whole continuance of the disease, their sputa was simply mucous, or viscous and tenaceous, or pituitous, but never purulent or puriform.

From these observations does it not seem demonstrated, that in cases of hepatization, or condensation of the pulmonary tissue, pectoriloquy may exist in a more or less perfect degree, if the part thus hardened be close to the trachea or in contact with it, or traversed by large bronchial tubes?

The pulmonary tissue, from its acquired density, is become more fitted for receiving

and transmitting the vibrations of neighboring bodies and of those it surrounds.

M. Cruveilhier also made this observation, and has explained it publicly in his lecture on pneumonia, at the Faculty of Medicine of Paris, on the occasion of the "Concours" for the situation of aggregate.

Egophony (or hægophony*) is a strong resonance of the voice, more sharp, more acute, than that of the patient; in some degree argentine, jerking, and tremulous, like that of a kid.† This phenomenon may be produced in the whole extent of the chest, on one side only, or on both sides at once; but it is rarely that it is not confined to a tolerably circumscribed space, of which the vertebral column, the inner border of the scapula, its inferior angle, and its outer edge, form the limits.

When it exists on both sides together, it is difficult to decide whether it be a consequence of disease: in some subjects the

* *Ægophonism*, Forbes.

† It often closely resembles the voice of Punchinello, and considering the part it is heard in, can hardly be mistaken for any of the other phenomena.

natural resonance of the voice at the root of the lung has this sharp bleating character.

Hægophony varies much in force and extent ; but however weak it may be, it seems to me always to indicate with certainty the existence of a moderate quantity of liquid in the cavity of the pleura, or of pseudo membranes tolerably thick, and still soft.

When the effusion becomes too abundant or too small in quantity, hægophony ceases to exist. I have never found it when the effusion of the liquid took place very rapidly, and the affected side was filled almost suddenly.

Can this phenomenon be explained by the quivering of the voice on the surface of the liquid, as M. Laennec formerly thought ? Or is it owing to the flattening of the bronchial tubes, as he teaches at present ?

A woman presented hægophony towards the root of each lung in turn : she died. No liquid was found extravasated ; the flattening of the bronchia was not very evident.

Another died after long suffering. For three years she had been pectoriloquous in the summit of the lung, and hægophonous at the

root of that organ in a very circumscribed space. There was no extravasation, and although surrounded by a very dense pulmonary tissue, the bronchia did not appear to me altered in their form.

A man was carried off by pneumonia; the dulness of percussion, the presence of hægophony, and the absence of all respiratory murmur, had made the existence of effusion be suspected: four hours before death the patient was still hægophonous. There was no liquid extravasated however; but there was a tolerably thick and slightly consistent layer of false membrane upon the root of the lung. The bronchial tubes offered nothing particular. I will confess that it is very difficult to discern whether there is flattening of these tubes or not; they are not naturally cylindrical, and perhaps a very slight degree of closing may cause hægophony.

These three facts, unique as far as I know, do not hinder me from believing that this phenomenon indicates with certainty a moderate extravasation of fluid into the cavity of the thorax; but they seem to me sufficient to make us reject the first explanation of

hægophony, and insufficient to prove the second.*

* The student will do well to consult the last edition of LAENNEC, and the able translation of that work by DR. FORBES; the former, vol. i. p. 69; the latter, p. 39. The following are extracts:

“Ægophony may be readily confounded by the inexperienced with pectoriloquy; and still more so with bronchophony. Laennec himself was long guilty of this mistake. The distinction is easy when the respective characters of each are strongly marked; but there occur cases in which this is hardly practicable.”

“Laennec observes, ‘In comparing the results of my early and more recent experience respecting ægophonism, it seems to me certain that it exists only in cases of pleurisy, either acute or chronic, attended by a moderate effusion in the pleura, or in hydrothorax or other liquid extravasation in the same cavity.’

“All the cases in which I have observed ægophonism, since I have been able to discriminate it from pectoriloquism and bronchophonism, have at the same time afforded other undoubted signs of effusion into the chest. In the examples of pleurisy which I have been able to attend to from their commencement to their close, I have found it as early as the first hours of the attack; but it has never been observed strongly marked until the second, third or fourth day, and hardly ever until after the sound of respiration has become almost or altogether inperceptible in the affected side, and until this has yielded the dull sound

ART. III.—*Phenomena furnished by the Respiration and Voice.*

Metallic respiration, resonance, and tinkling. These three phenomena are very remarkable. Let us first explain the lesions

or percussion. I have observed ægophonism in every case of pleurisy which has come under my care during the last five years, except in a very few slight acute cases, where the effusion (as proved by the auscultation of the respiration, and by percussion) was inconsiderable, and in those which did not come under my notice until far advanced, and when they were in progress towards recovery. I have discovered this sign where there did not exist more than three or four ounces of fluid in the chest. Ægophonism decreases and gradually disappears as the effusion is absorbed. In very acute cases, it exists frequently two or three days only, and then totally disappears. In the chronic state of the disease, with moderate effusion, I have found it sometimes continue for several months with variations of intensity proportioned to the varying quantity of the effused fluid. When this is very great, particularly when it is sufficient to cause dilatation of the chest, ægophonism ceases entirely. * * * *

Ægophonism, is not, like pectoriloquism, confined to one point, but extends over a certain continuous portion of the chest. * * *

which they indicate, that we may render their explanation more easy to comprehend.

These morbid states are a fistulous communication between the cavity of the pleura

“I consider ægophonism to be owing to the natural resonance of the voice in the bronchial tubes, rendered more distinct by the compression of the pulmonary texture, and by its transmission through the medium of a thin and mobile layer of fluid. This opinion is supported by many facts and reasons. The points where it is constantly found, correspond with the upper border of the fluid, and where it is of the least thickness.”

“From the preceding observations I think we are entitled to conclude, that ægophonism is a favorable sign in pleurisy, as it seems uniformly to indicate a moderate degree of effusion. Its continuance for some time is a favorable omen, as showing that the effusion does not increase ; if it continues as long as the fever, or longer, we may be assured that the disease will not become chronic, as this never happens except when the effusion is extremely abundant. I have frequently drawn this prognostic, and have never been deceived in it.

“When I published the first edition of this work, I was not quite sure that ægophonism might not exist in simple peripneumony ; farther experience, however, has completely convinced me that this cannot be the case.

and the bronchia, and the accumulation of a certain quantity of air in the sac formed by that membrane ; an effusion both liquid and gaseous, with or without communication ; finally, a very large excavation, with thin and compact adherent walls. Metallic respiration, and metallic resonance, will exist in the first case ; metallic tinkling will be joined to them in the third, or will be found alone if there be no bronchial fistula.

If we make a patient in whom this communication exists, breathe strongly, the air in penetrating the pleural cavity, produces a murmur similar to that caused by blowing into a rather narrow-mouthed metal vessel. If we make him speak, his voice bounds under the cylinder, and resounds as if he spoke in a cistern. This is the more striking, as the phenomenon is sometimes evident

“The following positions seem proved: 1. That ægophonism exists in simple pleurisy, and in no case with more decided characters; 2. That bronchophonism exists frequently in peripneumony, and with features sufficiently well marked to distinguish it from ægophonism; 3. That both these co-exist in certain cases of pleuro-peripneumony.”—ED.

only at the end of the sentence, and seems to be an echo.

Finally, if an effusion both gaseous and liquid exist, and we make the patient rise, to examine him, it sometimes happens that we hear a sound of short duration, similar to that of a drop of water falling into a decanter three fourths empty. It seems as if a drop remained sticking to the upper part of the cavity, and falling into the lower part, then occupied by the effused fluid, produced this noise by its fall into the mass of liquid.

These phenomena never fail to become evident, from time to time, at least during the continuance of the symptoms they denote. It is scarcely necessary to say that we often examine the patient several times before an opportunity occurs of hearing them. The obstruction of the fistula or bronchia communicating with it makes them disappear. A certain proportion between the liquid and gaseous effusion is necessary for their production in a very distinct degree.

Agitation of the air, its passage through a narrow opening, and the resounding of the voice in a large cavity with firm walls, half

solid and capable of vibrating with force, easily account for the metallic respiration and resonance. The explanation of the tinkling which I have given, seems probable enough.*

ART. IV.—*Phenomena presented by the Heart.*

These pathologic phenomena, like the natural ones, are referable ; 1st, To the extent in which we hear the pulsations of the heart, by the aid of the cylinder ; 2d, To the shock or impulse of the organ ; 3d, To the nature or intensity of the noise caused by its contractions ; 4th, To the rhythm, according to which its different parts contract.

1st, *Extent.* The extent of its pulsations may exceed their natural limits, or be con-

* In the last edition of LÄENNEC, the author states, that the metallic tinkling always originates in a morbid excavation within the chest, containing partly air, and partly liquid. It exists only therefore in two cases ; viz. where a serous or purulent effusion coexists with pneumo-thorax ; or when a very large tuberculous excavation of the lung is only partly filled with very liquid pus.—ED.

fined to a very small surface. But before entering into any details on this subject, it is necessary to establish a distinction between the extent in which we hear the pulsations, and that in which they may be felt.

The increase of extent in which the pulsations become evident, is usually in the following order: 1st, The left side of the chest, from the axilla to the region corresponding to the stomach; 2d, The right side in the same extent; 3d, The left posterior part of the chest; 4th, Lastly, but rarely, the posterior part of the right side. The intensity of the sound is progressively less in the succession indicated.

The possibility of hearing the heart in these different regions always indicates a state of weakness of the organ, a small degree of thickness of its walls, particularly of the ventricles; the passive dilatation of some of its parts.

It may also depend on causes not connected with the heart, the action of which may be either permanent or temporary; such are the thinness or narrowness of the chest, hepatization of the lung, its compression by

effused fluid, the existence of excavations with firm walls, pneumo-thorax, nervous agitation, an intense fever, palpitation, hemoptysis, and in general all the causes which increase the frequency of the pulse.

The diminution of the extent in which the heart's pulsations can be heard, usually announces a more or less marked thickening of its walls; it is not very often observed.

It is less rare to observe, that in the same circumstances, the pulsations of the heart seem to confine themselves so as to be felt in a smaller extent than in the sound state; on the contrary, when the heart is dilated, it strikes the sternum by a large surface. The two last observations are not always correct: I have met with numerous exceptions.

2d, *Impulse*. We have said, how many varieties the intensity of the shock of the heart in the healthy state offered to the ear, so it is very difficult to pronounce decidedly upon its increase or diminution, unless they are strongly marked, or do not exist at both sides at once, which is generally the case.

The increase of impulse offers numerous degrees, from a slight excess of force, to that violent shock which communicates a disagreeable stroke to the head of the observer, and raises the walls of the thorax strongly enough to be visible at a certain distance. It is almost always in direct proportions to the thickness of the ventricular walls, and in inverse proportion to the extent of the pulsations: it is then the pathognomic sign of hypertrophy of this organ.

Quick walking, running, ascending, nervous agitation, palpitation, fever, may produce it temporarily without any alteration of the heart; so we should not proceed to an examination till after a considerable repose of body and mind. Venesection lessens this impulse; we should judge badly of its degree after this operation.

The diminution of the impulse, though rarely, is sometimes as exaggerated as its increase; it depends at one time on the weakness of the organ, the small degree of thickness of its walls, and coincides with extended pulsations; at another, on extreme obstruction of respiration, on the difficulty of pul-

monary circulation, and may then coexist with a well characterized hypertrophy. This diminution is often observed in the latter stages of the complaint; certain affections of the mind, fear, depressing passions, may also produce it.

3d, *Sound*. The sound of the contractions of the heart may become dull or more clear, more sonorous than in the natural state. It may give rise to sounds wholly new, of which not even the rudiments can be perceived in the healthy state of the organ.

The diminished intensity of the sound seems to depend on the softening of the tissue of the organ, or on an increase of the thickness of its walls; it is, with feebleness of impulse, the only sign furnished by the cylinder of the first of these affections, a disease rare and most usually mistaken.

The clearness, the sonorousness of the contractions is much more frequently observed; it is always met with in a heart having thin walls, and indicates this natural or pathological condition. This clear noise may proceed from the auricles or the ventricles. The time and place at which it is heard, in-

dicates the part which gives rise to it ; it always announces a thinness of the portion of the heart of which the contraction takes place.

As to the sounds which present themselves, not having any rudiment in the healthy state, we shall refer them to three heads. 1st, The bellows blast ; 2d, The rasping noise ; 3d, That which has some resemblance to the creaking of new leather.

1st, *The bellows blast*, tolerably well characterized by its name, may accompany the contraction of the different parts of the heart, or that of the arteries, either all at once or partially. It may be constant, or only return from time to time without any appreciable cause, on the slightest movement, or from the slightest emotion. The nervous, the hysterical, and hypochondriacal, those subject to any hemorrhage, present this phenomenon most frequently, without any alteration of the heart's structure, or any disturbance of its functions. It may also exist during disease of this organ in persons of none of the above dispositions.

At the opening of the dead bodies of those who have presented it in the highest degree, and in the most constant manner, in the heart and arteries, we do not meet any constant lesion to which it may be reasonably attributed.

M. Lænnec regards it as indicative of a simply spasmodic state of the circulating vessels, or of some part only of the sanguineous system. Many observations seem to prove this opinion:—1st, Its analogy to the noise produced by a forced muscular contraction, of which it is easy to assure ourselves. In fact, if we support the elbow upon a table, rest the ear forcibly upon the hand, and contract and relax the lower jaw alternately with energy, we hear a sound quite similar. 2d, The facility with which we cause it in some persons in a great number of arteries alternately, by resting lightly upon a point of the vessel, contracting its calibre, and thus offering to the course of the blood an obstacle which does not completely retard its progress. 3d, Its appearance before active hemorrhages in the vessels which carry the blood to the part through which the hemorrhage is about

to take place. 4th, Its constant existence in cases of palpitation produced by anemia.

I know that these ideas upon the bellows blast naturally lead to the admission of the power of contraction in arteries, and represent them as in a part independent of the heart. But do not other facts render this almost evident? Thus the very common want of proportion between the force of the heart's pulsations and of those of the arteries; the development of the circulating phenomena in a part of small extent, the rest of the system remaining in the most perfect calm; that unusual sensation of pulsation which attends some inflammations, whitlow, for example, a sensation which is not illusive, since the finger applied upon the diseased part feels the same sensation; the pulsations felt within the cranium of persons suffering from hemicrania; the non-transmission of all the pulsations of the heart to the arteries, in cases in which this organ, being hypertrophied, is agitated by tumultuous and very much accelerated movements; the existence of the bellows blast in the vessels which transmit

the blood from the uterus to the placenta, as lately discovered by M. Kergaradec.

2d, *The noise of the rasp or file*, of which the denomination gives an exact idea, which it is impossible to mistake when once it has been heard, may, like the bellows blast, accompany the contraction of any of the parts of the heart; but it is not intermittent like that, its strength alone varies; once developed it ceases no more. M. Läennec regards it as a certain sign of contraction of the orifices of the heart by ossifications, vegetations, or other cause. The period of the contraction, and the place in which it takes place, indicate the orifice affected. Does not the possibility of producing a very similar noise in a person subject to the bellows blast, by pressing on an artery with a certain force, appear to announce that this is but a modification of the other, owing to a more marked state of spasm caused and maintained by an obstacle more difficult to overcome and always equally resisting?

3d, *The sound resembling the cracking of new leather* has only once presented itself to our observation; it was in a man who was

carried off by a chronic pericarditis. The sound lasted during the first six days of the disease, and disappeared as soon as the local symptoms announced a considerable effusion into the pericardium. M. Devilliers, internal pupil at the Hospital Saint Antoine, observed it at the same time in the case of a man, who, from other symptoms, seemed to suffer from pericarditis. He was then ignorant that this phenomenon had already been observed in this affection, and did not found his diagnostic upon it. The patient went away after a tolerably long residence in the hospital. He presented himself again without having experienced any relief from the mode of treatment made use of. It is to be regretted, that if the patient has died, the diagnostic has not been verified by inspection. A second time M. Devilliers had an opportunity of examining the dead body of a man who had presented this noise during the whole time of his abode in the hospital. He discovered a chronic pericarditis, which had produced thick false membranes and numerous vegetations over the pericardium and heart. There were only a few adhesions

between this organ and its envelope, and the sac of the pericardium did not contain a drop of serous liquid. Perhaps this noise may be a constant symptom of pericarditis before the occurrence of effusion into the serous envelope of the heart, a fugaceous symptom, when the disease terminates in a few days; of longer duration, when it is chronic.

Rhythm. The changes in the rhythm of the heart's pulses are not very rare; but for want of sufficient observations, we have not been able to convert them into diagnostic signs.

They often accompany an hypertrophy, a dilatation of the heart, or the contraction of its orifices, during the whole duration of the complaint; they often manifest themselves also only in the later stages of these affections; at other times these lesions produce death, without the rhythm of the pulsations having been irregular.

We shall consider the alterations of the rhythm; 1st, Relative to the respective duration of the contractions of the auricles and ventricles; 2d, Relative to their succession.

1st. The alterations of the rhythm rarely depend on the duration of the auricular contractions ; they are usually owing to the increased length or the shortness of the ventricular contractions, and then it is the period of repose which is increased or diminished. The first of these alterations, that which consists in the prolongation of the ventricular contraction, is observed in hypertrophy, and is the more evident as the disease is more marked. The second, that in which there is greater rapidity of contraction, coincides with different states of the pulse, swiftness, rarity, and furnishes no data upon which we can found our diagnostic of diseases of the heart and lungs.

2d. These alterations, considered as they relate to the succession of the pulsations, have been sufficiently often observed ; they are usually transitory, and rarely attend more than two or three complete contractions of the heart.

Thus sometimes the contraction of the auricle anticipates that of the ventricle ; at others, that of the ventricle anticipates the auricular contraction ; or again, a contraction

of the ventricle is followed by many successive, rapid, as it were, convulsive contractions of the auricle, which, taken together, do not exceed the duration of an ordinary contraction.

The greater part of these anomalies do not produce any sensible change in the state of the pulse, and are not constantly met in any of the diseases of the heart.

In the midst of a series of contractions equal to each other, we often observe many shorter, more lively beats, after which the heart returns to its natural rhythm.

At other times, after a series of regular pulsations, the heart seems to stop, and remain for a very long time in a state of repose. These kind of intermissions, observed in an adult, are always the sign of an affection of this organ.

In fine, in some more rare cases the swiftness and irregularity of the contractions are such, that it is impossible to analyze them. In this case we may pronounce with certainty that there exists a disease of the organ.

We see from this explanation of the pathologic phenomena furnished by the heart,

that there are only two, impulse and sound, which become certain signs of lesion of different parts of this organ; that all the others drawn from the rhythm, bellows blast, and rasping sounds, &c. have not been sufficiently often observed to enable us to say what alterations they indicate. But I doubt not that attentive observation of those diseases, and their daily observation with the cylinder, may one day furnish the information now wanting, and very soon render the diagnosis of these affections as precise and easy as most of the other diseases of the thorax.

ART. V.—*Of Mensuration.*

This mode of inquiry consists in measuring one side of the chest and comparing it with the opposite side. The contraction or expansion would not be evident, if both sides were affected at once; so this examination can only be comparative.

In some diseases, mensuration affords a valuable sign to assist the diagnosis, but is not sufficient alone to establish it.

In reality, most men have the right side more developed than the left; a great number exhibit slight alterations in the formation of this cavity, resulting from their disposition to rickets in early infancy; it is therefore necessary to overlook very small differences. At the first glance every patient seems to present a dilatation or contraction, and without the assistance of mensuration, this amplification would seem much less rare.

In proceeding to this mode of examination, the patient is to be seated or standing; the body straight, and the upper limbs raised over the head or hanging along the sides, but always in the same relative position; for the state of contraction or of relaxation of the muscles varies their projection, and may simulate a deformity which does not exist.

The half circumference of the chest is to be measured by placing one end of a cord * upon the spinous processes of the vertebræ, and carrying the other round to the centre of the sternum; then, without quitting this point,

* A graduated measure, in a small case, such as is used in ladies' workboxes, is much more convenient.—ED.

bringing the cord round the other side to the spinous processes again, in the same direction and at the same height.

It would perhaps be better to surround the whole chest with a cord, and then to fold this exactly in the middle; it would then give the measure of the extent that each side of the chest ought to have, with which we should proceed as above directed. This method of inquiry furnishes only two signs, dilatation and contraction.

Enlargement is always attended with flattening (*redressement*) of the ribs, widening of the intercostal spaces, and more or less complete immobility of the enlarged part; I say of the part, for this morbid enlarging may be of a whole side, or only of a part of one. Every effusion into the cavity of the pleura, at all considerable, necessarily produces dilatation.

The contraction is accompanied also with change in the direction of the ribs; they are more oblique, little or not at all moveable; the intercostal spaces are narrower, sometimes almost effaced; like the dilatation, it is total or partial, but it occupies a whole

side oftener than this. Persons who present this alteration have a peculiar carriage, well described by M. Läennec, by which it may be guessed at the first glance.* The shoulder is depressed, the side of the chest shorter and flatter, the flank hollow, the pectoral muscles wasted, the head somewhat inclined towards the contracted side. In most, the vertebral column preserves its natural rectitude; in a few it bends. This contraction is always the consequence of an intense pleurisy, accompanied with an abundant effusion of a liquid which has been absorbed. I think I have observed, in some cases of phthisis, a flattening at the summit of the chest beneath the clavicles, and that in those cases there was a very strong and close adhesion between the pulmonary and costal pleura, in the whole extent of space corresponding to the contraction.

* See plates 3d & 4th.

ART. VI.—*Of Succussion.*

This mode of inquiry, of which Hippocrates is agreed to have been the first proposer, consists in giving the trunk one or more abrupt rapid shakes, to produce the fluctuation of a liquid suspected to exist within the chest, and to assure ourselves of its presence and quantity. The shake need not be violent; a slight agitation is sufficient. This shake communicated suddenly to the liquid, causes a sound quite similar to that of shaking a bottle half full. It is needless to say, that this noise cannot exist if there is not at the same time air or gas, and liquid effused. The chest is always exactly filled, if it is the lung which occupies the portion not filled up by the effused liquid, and this cannot thrust it back to produce the sounding shock. If the gaseous effusion be in too great or too small quantity, succussion affords no satisfactory result. The two effusions must be in certain proportions.

When this sound exists, it cannot be confounded with any other; I do not think that the fluids contained in the stomach can

give rise to it. Besides, it will always be easy to recognise with the cylinder the spot in which it occurs. The patients are often the first to advertise you of its existence ; they hear it at every stir ; the ear is usually sufficient to recognise it.

PART. II.—CHAP. I.

Of Diseases of the Pleura and Lung.

THE five methods of investigation just explained, are all generally of real utility ; and we shall see that each is successively called upon to furnish signs peculiar to a disease ; that in most cases they afford a mutual and necessary aid ; and that in adopting only one, even the most perfect, to the exclusion of the others, we expose ourselves to frequent mistakes.

If it were necessary now to class them according to their usefulness, we should not hesitate to put auscultation in the first rank ; after it percussion, succussion, mensuration, and last, the examination of the thoracic movements.

There is no disease of the chest in which auscultation does not furnish some sign.

Among these some are sufficient alone to characterise the complaint; thus the different kinds of rattle in catarrh, and in peripneumony; hægophony in pleuritis; pectoriloquy in excavations of the lung; the metallic tinkling in pneumo-thorax. Others, though fewer, are common to many diseases; then auscultation becomes insufficient, even deceptive, and we must have recourse to another method.

Percussion is the method which gives most aid to auscultation. It unites with it to strengthen the diagnosis of the first mentioned affections, and in others prevents the errors which might follow the use of the cylinder alone. Thus it establishes the distinguishing character of peripneumony in the second stage from emphysema of the lungs, pneumo-thorax, and emphysema, slight œdema, and the first stage of peripneumony.

Succussion gives the pathognomonic sign of pneumo-thorax with effusion. Mensuration gives one of the constant characters of empyema, which can sometimes be distinguished by this alone from hepatization of the lung.

The observation of the movements of the chest furnishes indications of the intensity, extent, and sometimes of the nature of certain affections; and further, a constant symptom of acute inflammations of the thoracic organs.

Who does not know that in these affections the first phenomenon which catches the eye is the immobility of the whole or part of one side of the thorax? Pain in this case destroys the simultaneous action between the symmetric portions of the chest. What the will cannot effect, nature does unknown to us, by the simple automatic effect which leads us to withdraw ourselves from the feeling of pain. We see from what has just been said, that in assigning a place to each mode of inquiry, according to its utility, I am far from excluding any of them.

In a *materia medica* we thus class medicines of the same order according to their degree of energy, without meaning that the strongest should make us reject the weaker.

I shall divide diseases of the thorax into

those which affect the respiratory organs and those which affect the heart.

It is necessary to adopt an order for the explanation of the diseases of the lungs. To preserve the connexion and unity of my work, I have assumed as a basis that which I have followed in making known the phenomena recognised by the cylinder. This method has appeared to me, besides, to unite the advantage of proceeding from simple to compound, in the application of the different stethoscopic phenomena to the diagnosis of diseases.

I shall first make mention of the affections which the examination of the respiration makes known, and then those in which we must join to it the examination of the voice. To this first division I refer pleurodynia, pulmonary catarrh, apoplexy, œdema, and emphysema of the lung, pneumonia, hydro-thorax, and empyema; to the second, pleurisy, pulmonary phthisis, gangrene of the lungs, and pneumo-thorax.

ART. I.—*Of Pleurodynia* *.

I speak here of this affection, because I have observed some cases in which, though slight and of little importance, it has given rise to the belief in the existence of a severe disease of the lung, or of the pleura.

In fact, when the muscular pain is violent, the ribs which correspond to all the diseased part remain immoveable in the actions of respiration ; it becomes then more or less incomplete.

Percussion returns a dull sound, either because the pained muscles cannot be stretched, or that the cause which has produced the pleurodynia has also caused a tumefaction of the fleshy covering of the chest. The respiratory murmur is weak in a greater or less extent, or wholly absent.

These symptoms are also common to pleurisy and pneumonia. When treating of these diseases we shall find the differences which distinguish them.

* This is usually termed by us, false pleurisy. It is a rheumatic affection of the membranous part of the thoracic parietes.—Transl.

ART. II.—*Pulmonary Catarrh**.

In bronchitis, the examination of the movements of the chest furnishes few important signs; the respiration is frequent, quick, small, unequal, irregular; but these alterations appertain equally to many other diseases. They can only concur in indicating the degree of intensity and the extent of the catarrh. The resonance of the breast is natural, and the most severe catarrh rarely causes more than a slight obscurity of the murmur.

Mensuration and succussion give no information; there only remains the stethoscope; but the signs it furnishes are truly pathognomic; they vary as the catarrh is dry or moist. In the dry catarrh we observe weakness, or even absence in the respiratory murmur in parts of the lung of greater or less extent; but these change every moment, and during the course of a short examination, may occupy different points in turn, so that the murmur may become distinct where it was absent, and absent where it had just before been clearly perceived.

* Bronchitis.—Transl.

This weakness of the respiratory murmur is very often accompanied with the dry, sonorous, or the sibilant rattles. The first, little variable ; the second, very much so, disappearing for a longer or shorter time after the effort of coughing, or even without any evident cause ; returning abruptly, assuming an increased intensity, or losing that which it had at first. Sometimes, however, both are constant, intense, and occupy the greatest part of the organ: the catarrh is then extensive and violent.

In the humid catarrh the same phenomena may exist, but they are then usually attended with a third, the mucous rattle ; or this alone is heard, and is sufficient to characterize the complaint. Less frequently varying its situation than the hissing rattle, the mucous rattle presents shades, either in force, frequency, or extent, which make known the different degrees of the catarrhal affection. Catarrh may be easily confounded with emphysema of the lung and pulmonary phthisis. (See Emphysema and Pulmonary Phthisis.)

ART. III.—*Pulmonary Apoplexy**.

The attack of this disease being usually sudden, we observe all at once a great degree of dyspnœa; the movements of the breast are accelerated, hurried; there is no longer any order in their succession, the most striking irregularity accompanies them; they are unequal, intermittent, large, and small, by turns, as if convulsive; in fine, the patient is in that state, termed *orthopnœa*: he is suffocating, and all the thoracic movements express the anxiety caused by this uneasy sensation. The breast however remains as sonorous as before the attack, but the respiratory murmur is altered. The crepitating rattle develops itself in more or less numerous and circumscribed points of the lung. The spaces between these still present a perfect, and even puerile respiratory murmur.

At the end of a longer or shorter time it ceases to be heard; an abundant mucous rattle in large bubbles, succeeds to it, indicating a copious exhalation of blood into the air cells and bronchia, occupying very soon the whole

* Hæmoptysis.—Transl.

lobe or affected lung, and the bloody expectoration soon confirms the diagnostic already pointed out by those phenomena.

In the second stage of pulmonary apoplexy, the sound of the chest (on percussion) becomes obscure.

In the first, it may impose on us for a commencing pneumonia; in the second, for a catarrh, if it is chronic, and that the spitting of blood, as is generally the case, is not constant. I have lately observed two cases of this slow apoplexy of the lungs. They were both mistaken for some days. The distinguishing signs of those two affections can only be known by commemorative circumstances, and a certain diagnosis will always be difficult.

ART. IV.—*Œdema of the Lung.*

Respiration usually slow, but laborious, difficult; from time to time orthopnœa, respiration always complete.

Sonorousness, natural or dull, but of both sides at the same time. This disease rarely occupies a single lung. Respiratory murmur

scarcely distinct, marked in almost the whole viscus, but chiefly in the back and inferior parts, by a sub-crepitating rattle, slight and energetic, but constant in its existence; the respiration sometimes puerile in a small extent of the upper part of the organ. Such are the symptoms of œdema of the lung.

The diagnosis of this complaint is easy, when the disease is severe; but difficult, when it is slight; impossible, when it is complicated with pneumonia or emphysema of the lungs. It may be confounded with pneumonia (See Pneumonia). The nature of the rattle, and particularly the general symptoms, distinguish it from catarrh.

ART. V.—*Emphysema of the Lung.*

This complaint, among the number of those which have been long confounded under the name of asthma, is characterized by an extreme dyspnœa, increasing by paroxysms, without any regularity in their return or duration, and exasperated by the most trifling cause. The movements of the chest are extensive, but performed with little

regularity, habitually unequal; inspiration is usually short, rapid, abrupt, and high; the expiration gradual and incomplete: the difference between the duration of those two movements makes the respiration seem interrupted. In the paroxysm it becomes convulsive.

On percussion, the chest yields a more than naturally clear sound, whatever may be the degree of plumpness of the patient.

But this exaggerated resonance is not equal at all points, because the disease rarely occupies a whole lung. If the affection is double, it is difficult to appreciate this increase of sonorousness of the thorax, and when the emphysema exists only on one side, it becomes a deceptive sign, the value of which can only be judged by auscultation.

In fact, the murmur of respiration is very weak or wholly absent in all the points attacked by emphysema; a slight sibilant rattle similar to the clicking of a small valve, or a sonorous rattle imitating the cooing of a dove, is heard in deep inspirations, and sometimes also in expirations. The contrast of this greater resonance (or hollowness) of the

thorax, with the diminution or absence of the murmur, forms a characteristic symptom of this disease. It is true that these characters of the respiration and the existence of the rattle are inconstant and variable; but they always remain a long time, and their changes are only momentaneous.

When the complaint is chronic and very extensive, another sign drawn from the mensuration may be added to those just enumerated, the dilatation of the side affected; and if the affection is on both sides, the almost cylindrical form of the chest projecting behind and before. Emphysema, sometimes distinguished with difficulty from pulmonary catarrh, may also be taken for a pneumothorax without liquid effusion.

Let us first explain how it differs from catarrh. In catarrh the suspension of the respiratory murmur is of short continuance in the same point; its return is sometimes marked by a strong and even puerile respiratory murmur; a frequent rattle attends it.

In emphysema, the suspension of respiration at the same point is longer, sometimes even permanent; when it ceases, the sound

always remains more feeble, particularly if the complaint be ancient. The hissing rattle is rare, and badly characterized; the sonorous rattle, imitating the cooing of the dove, is constant, and almost never determined by a simple catarrh.

Besides, in this last affection, the movement of the sides is free; the respiration presents no constant inequality; the chest preserves its natural capacity and hollow sound. In emphysema, one side is often less moveable than the other; inspiration is always very short, relative to expiration; the chest dilates, and acquires a tympanitic resonance.

It is scarcely of use to say that percussion establishes at once the difference between emphysema and the other diseases of the chest in which respiration appears to the cylinder more feeble or absent: I only except pneumo-thorax. (Sec Art. Pneumo-thorax.)

ART. VI.—*Pneumonia.*

To establish the signs afforded by the five modes of inquiry in pneumonia firmly, we must distinguish three periods in this com-

plant. We may perhaps admit even a fourth, founded upon the observations related above ; but it appears to me very doubtful that in all cases the respiration assumes the puerile and superficial character in parts about to be attacked with pneumonia. New observations will soon teach us what degree of confidence this phenomenon merits.

In the first stage of pneumonia, the respiration is high, small, accelerated, unequal, difficult, sometimes laborious. It becomes abdominal, if both sides are at the time affected in a high degree.

The chest sometimes sounds as in health ; but its sonorousness is often diminished, and even completely lost in a more or less considerable extent, very exactly limited to the part diseased.

The respiratory murmur is feeble, in all parts where the sonorousness is diminished scarcely distinct, or sometimes covered by a crepitating rattle ; at one time dull, at another sonorous enough, and the presence of which indicates both the nature of the alteration and the whole extent it occupies. The respiration then often becomes puerile in the

other lung, and in all the parts of the affected lung yet remaining healthy.

These phenomena very soon change. If the disease terminates by resolution, the crepitating rattle diminishes in intensity every day; the murmur of respiration approaches more and more to the natural state; the movements of the chest resume their rhythm, their extent, and simultaneousness; the sound returns, and the mucous rattle, in a greater or less degree, indicates the change of expectoration.

On the contrary, if the lung passes to the state of hepatization, the alteration of the movements of the thorax continue, the sound becomes completely dull, the crepitating rattle ceases, but the respiratory murmur does not return; the smallest quantity of air cannot penetrate the hardened tissue of the lung. Respiration is wholly absent, or if heard, is so only in the vicinity of the large bronchial tubes; it is then tracheal, cavernous, and often very loud; the hollowness of the voice redoubles in all the affected parts; often in induration of the upper lobe even a true pectoriloquy begins to complicate the diagnosis,

and throw doubts upon the nature of the affection. We must have recourse to the commemorative circumstances, to the general symptoms, to prevent our supposing the existence of pulmonary phthisis.

When the disease is of small extent, nature and art exert their powers, and are often at this period crowned with success ; the disease retracing its steps by the same way it advanced, presents in turns and in inverse order the phenomena before observed. But if the complaint continue its progress—if the suppurative process seizes upon the pulmonary tissue, the movements of the chest become smaller and smaller, feeble and more difficult ; to the first causes of their alteration general debility is added. The sound remains dull ; a large bubble mucous rattle is first developed in isolated points, then in all the morbid part. It soon degenerates to the gurgling rattle ; the pus collected in an abscess bursts into the surrounding bronchia ; a communication is formed between these tubes and this accidental cavity, and pectoriloquy manifests itself, at first obscure, whatever may be the point the disease occupies.

We see, from this abridged sketch, that each stage has very striking characters; and that if we have been called in at the commencement of the complaint, and have been able to follow the progress of the disease, step by step, it is easy to predict, in case of death, the extent and degree of lesion that will present itself. It is not so if we see the patient for the first time in the second state, when the lung is hepatized. In fact some ribs are immoveable, the sound is dull, the respiration absent; but those symptoms are common to empyema and hydro-thorax. Here the five modes of inquiry are insufficient, and we must seek for information in the amnestic signs and progress of the disease. Percussion and auscultation could not prevent an error always disagreeable, sometimes fatal.

In the third period, that of suppuration, it is difficult to guard against a mistake, less unpleasant indeed, but which may compromise the reputation of the physician.

The cavernous respiration, the gurgling, and pectoriloquy exist, and the general symptoms are nearly those of pulmonary phthisis.

As to the chronic pneumonia, after a vomica has formed and burst into the bronchia, we must apply to it what we have said of the second degree, that of hepatization, or of the third, that of suppuration.

It remains to say what signs distinguish pneumonia from pleurodynia, from the first degree of pulmonary apoplexy, and from œdema of the lung. The crepitating rattle in the first state ; the dull sound on percussion and perfect absence of respiratory murmur in the second ; the dulness, mucous rattle, and pectoriloquy in the third stage, distinguish pneumonia from pleurodynia. In most cases percussion would prevent our confounding this disease with pulmonary apoplexy, if the examination of the movements of the chest did not already afford a good diagnostic difference. In fact, in pulmonary apoplexy the respiration is always complete ; it is usually incomplete in pneumonia. The sound is always more or less obscure, often wholly absent, in the first stage of pneumonia when the crepitating rattle exists ; it remains clear in the first stage of pulmonary apoplexy. The crepitating rattle is seldom widely spread

in pneumonia ; it is so usually in apoplexy. The mucous rattle suddenly succeeds the crepitating in the latter.

In pneumonia the absence of all respiratory murmur exists sometime between the moment in which the crepitating rattle ceases, and that in which the mucous commences.

It is the same with œdema of the lung.

ART. VII.—*Empyema and Hydro-thorax.*

I join those two complaints together, because their symptoms are absolutely the same, and I refer what I have to say of them to the article of Pleurisy.

ART. VIII.—*Pleurisy.*

The signs afforded by the different modes in this disease, vary according to their being considered at the commencement, or after effusion has taken place.

In the commencement, that is before a serous or plastic liquid has been accumulated between the pleura and the lung, the movements of the thorax are enfeebled or almost wanting on the affected side. We

have daily opportunities of observing that the ribs of the affected side alone are immoveable, while the others continue to move. Respiration is frequent, particularly if both sides are affected at once, quick in inspiration, interrupted, irregular. These characters continue during the whole acute stage of the complaint.

Percussion is painful, but gives the same results as in the sound state.

The respiratory murmur is enfeebled, but pure, if the disease be not complicated; the capacity of the chest is not augmented. Finally, the symptoms are as in pleurodine—a disease it is impossible to distinguish from the commencement of pleurisy, except by the general symptoms.

When the effusion has taken place, and is in small quantity, the resonance usually becomes obscure in the lateral and posterior inferior parts, or in any point of the thorax, if the disease be circumscribed and an anterior pleurisy has produced adhesions sufficient to confine the liquid.

The cylinder applied along the spinal edge of the scapula, towards its *point* or *its*

outer edge, or in fine in any other place, even under the clavicles, according to the extent of the effusion, or the point it occupies, renders evident that sharp, tremulous, jerking voice, called by M. Lænnec hægophony. The respiratory murmur is absent or scarcely distinct, in all that part in which the sonorousness is altered. It becomes sometimes puerile in the upper parts of the lung.

If the effusion is very considerable in the beginning, or becomes so in the progress of the affection, the sound becomes wholly flat, the hægophony disappears, the respiratory murmur is no longer audible, unless short adhesions retain parts of the lungs near the ribs, and prevent them from being thrust back. The intercostal spaces widen, rise to the level of the ribs: these become flattened; the affected side enlarges, it becomes unfit for respiration, and its immoveability contrasts with the greater mobility of the opposite one on which side the respiration acquires the puerile character.

If absorption of the liquid takes place, hægophony reappears when the quantity is reduced to that necessary to the production

of the phenomena: it then gradually diminishes as the quantity lessens, and finally disappears altogether when the absorption is completed. However, the sound still remains a long time flat, and the respiration absent or feeble; the ribs fall, the intercostal spaces sink, are effaced; the chest contracts, and that side never assumes either its former volume or mobility.

The resonance increases, and the respiratory murmur is heard with any force only when the pseudo-membranes have been converted into an organized tissue, similar to cellular membrane, fibro-cartilage, or bone.

No disease can be confounded with pleurisy, so long as hæmophony exists, except commencing hydro-thorax.

This phenomenon is always a pathognomonic sign of these two affections; the other local and general symptoms serve to distinguish them.

But when the effusion is copious and the disease chronic, if we have not attended to its progress, we may take pleurisy for a hydro-thorax or chronic pneumonia, and reciprocally these affections for a pleurisy.

The anamnestic signs and the general symptoms alone can establish the distinction; this is the more important, as little can be done for chronic pleurisy, while powerful and efficacious remedies remain for hydrothorax and pneumonia. The operation for empyema is the only relief in chronic pleurisy, and would have more success without doubt if earlier performed.

However, the dilatation of the thorax, the perfect immobility of the ribs, seem to me not to exist in chronic pneumonia, and establish constant differences of character, unless the diseased side, having been before affected with contraction, has been incapable of enlarging.

As to the possibility of confounding chronic pleurisy and pulmonary phthisis, I think that even when there is not pectoriloquy, there are other characters sufficiently distinguishing to render this mistake hereafter impossible (*avoidable*, ED.); and even when they are complicated, it is often easy to distinguish them from each other.

The difference between pleurisy and pleurodyne is easily laid down. In pleurisy,

when we observe the respiration incomplete the resonance obscure, and the murmur absent or feeble, there will be hægophony at the same time; this phenomenon never exists in pleurodynia. If the effusion was copious enough to destroy the hægophony, there would be dilatation. Moreover, the error in any case cannot exist long.

ART. IX.—*Pulmonary Phthisis.*

To lay down the semeiology of pulmonary phthisis the more clearly, we shall admit it to have three stages, although this complaint is seldom constant in its duration, and so obscure in its progress as rarely to favor this division.

The first of those periods, that in which an inconsiderable number of tubercles are developed in the lung, presents on examining the local phenomena and the general symptoms, only the appearance of a catarrh of greater or less severity; it is sometimes concealed from observation, and does not seem to exist.

In the second stage, the tubercles are al-

ready in sufficient numbers to stifle, as we may say, the tissue of the organ in those places where they are most frequently observed to accumulate, and give rise to phenomena, insufficient to enable us to say with certainty that the disease exists, but enough to make us suspect it.

Finally, in the third, the melting, the softening, and evacuation of the tubercles, gives place to a phenomenon which is always a certain sign of this affection and the shades of which point out its extent and its intensity.

The change in the movement of the thorax are extremely variable in this tedious and melancholy complaint. They may be all met with during its progress, but are never of great use in the diagnosis.

In the second stage, the upper part of one side of the chest frequently returns a flatter and more obscure sound than natural, on percussion. The stethoscope applied to this spot makes known a feebleness, or even complete absence of the respiratory murmur, generally in an extent rather limited; the voice resounds with more force under the instru-

ment; but these symptoms only become signs of the complaint when they exist on one side alone, and are constant; it is only the comparison between the healthy and the diseased side which shows their value.

The sound on percussion very soon returns, and sometimes acquires even more intensity, or it loses still more of its distinctness, and from being obscure as before, becomes quite dull.

Pectoriloquy becomes at first doubtful, but does not delay long to acquire its greatest perfection, and ends by being again only imperfect, if the disease, continuing its progress, produces vast excavations. The phenomena produced by the catarrh are extended and aggravated from day to day, and continue to the moment of death.

If in all cases those two very striking periods, and this succession of phenomena existed, phthisis would cease to be a disease so often difficult to recognize; but how frequently does it not happen, that patients fall before the softening and evacuation of the tubercles, even before their accumulation has altered the sonorousness of

the chest, or injured the perfection of respiration.

The melancholy information acquired by the cylinder is certainly precious; but in most cases the disease is beyond the reach of art when it is discovered.

Chronic pulmonary catarrh must then be always confounded with phthisis, so long as pectoriloquy, or the three phenomena mentioned as signs of the accumulation of tubercles, do not exist*.

Phthisis will also be confounded with acute or chronic pneumonia, occupying the upper lobe of the lung; the distinguishing characters can only be found in the general symptoms and the appearance of the expectoration; and these are but little to be trusted to.

It will more rarely resemble emphysema of the lung, and percussion and the general symptoms will easily distinguish them.

The dilatation of the bronchia, a common consequence of long-continued pulmonary catarrh, gives rise also to the phenomena of

* The chief diagnostic symptom is the rattle which attends the catarrh.—Transl.

pectoriloquy. It is then impossible to avoid a mistake; time alone, and the progress of the disease, sometimes undeceive us.

ART. X.—*Gangrene of the Lung.*

This rather rare disease may affect the surface of the viscus; it then occasions a pleurisy, with or without pneumo-thorax; or it may develop itself in the centre of the organ. I have only twice had an opportunity of observing this mortal affection. The first time, I did not yet know the use of the cylinder; and the second, the disease was accompanied with pneumo-thorax of long standing, with liquid effusion and bronchial fistula; so that it was difficult, in the midst of the number of phenomena observed, to distinguish those which belonged to the gangrene exclusively.

But it is easy I believe to point out, from analogy, the symptoms this disease should present. In the first stage of the affection, they will often be similar to those of peripneumony or of a severe catarrh; in the second, they will resemble those of pulmonary phthisis.

The general symptoms, and more particularly the *repulsive odour*, and the appearance of the expectoration, will be sufficient in all cases, to prevent mistakes.

This disease then has no symptom peculiar to it alone.

ART. XI.—*Pneumo-thorax*.

The signs of pneumo-thorax vary, according as it is with or without communication with the bronchia. In either case it may be simple, or complicated with liquid effusion.

In the simple form, without bronchial fistula, the obstruction of the movements of the chest, and their alteration, is the same as in emphysema of the lung, sometimes even in a more marked degree.

The side affected returns a hollow, tympanitic sound, even when the thoracic walls have much thickness. Sometimes the lung is connected to the costal pleura at many points, by the cellular adhesions: then the sound nearly natural at those points, offers still more striking differences where there is no adhesion.

The respiration is wholly absent in all the extent occupied by the gaseous effusion: it is scarcely evident even towards the root of the lung, between the scapula and the spine.

This absence of the respiratory murmur is owing to two causes; 1st, The thrusting back of the lung, by the gas collected within the pleura; 2d, The presence of this gas itself, a bad conductor of so feeble a sound as that produced by the air entering the bronchial cells.

Finally, the side occupied by the gas is usually dilated, and presents exteriorly the same peculiarity as in empyema.

When the gaseous accumulation is produced by a laceration on the lung, or the formation of a fistula, which opens at once into the bronchia and cavity of the pleura, there are joined to the preceding, new signs easily understood, and always pathognomonic: these are metallic respiration, and metallic resonance.

In fine, when the effusion is at the time liquid and gaseous, and the festulous communication has taken place, besides the preceding signs we hear the metallic tinkling,

and succussion makes the agitation of the fluid within the chest evident; if there is no bronchial fistula, the two last phenomena alone are perceptible, to the exclusion of metallic respiration and resonance.

In the cases of two-fold effusion, percussion furnishes important signs; it produces a clear sound in the upper parts, a dull one in the most depending ones: so that by varying the patient's position, we can alter the part occupied, by the clear sound, and the dull one.

Percussion serves to distinguish this affection in all cases from those in which the respiration is not heard in a very extended space, and during a considerably long time.

We can scarcely then confound it, except with emphysema of the lung; but the chest rarely has so exaggerated a sound in this affection. The respiration is never completely inaudible; it is always evident towards the root of the lung; it is accompanied with various rattles, and reappears quickly enough, in parts where it has become inaudible.

CHAP. II.

On the Diseases of the Heart.

BEFORE commencing the investigation of the diseases of the heart, I may be permitted to say a few words upon the utility of the cylinder in these affections, and upon the real advantages to be derived from it in their treatment.

I will first observe, that none of the other methods is applicable to the diagnosis of injuries of the central organ of the circulation; that they only make known its complications, and only unmask the disease when it is beyond the reach of art. I except however percussion; but the cases in which it offers any advantages are extremely rare.

Corvisart, whose name presents itself so naturally when we speak of diseases of the heart, had without doubt made great progress

in this mode of distinguishing the alterations which take place ; it did not seem likely that the eye of the physician could ever penetrate more deeply into their progress, which is commonly so obscure, and in one day unravel symptoms the most difficult to recognize. In fact, this great observer, not content with distinguishing active from passive aneurism, has pointed out particular characters, drawn from the state of the face, its color, and the state of the pulse, which enable us to predict with certainty, whether the disease occupies the right or left cavities ; but all those symptoms only show themselves when the disease is of long standing, and art nearly powerless to destroy it. Few men, besides, are possessed of the medical tact which Corvisart enjoyed in so high a degree ; and, spite of his labors, mistakes are still of daily occurrence, and even well-informed physicians mistake those diseases every day.

The symptoms pointed out by Covisart, then, have the double inconvenience of being difficult to recognize, and of appearing too late. On the contrary, those afforded by the

cylinder show themselves from the commencement of the affection, and are detected with facility by even the most unpractised *. By a little practice he may even acquire such precision as to announce, without fear of being deceived, whether there be hypertrophy or dilatation; if such or such a ventricle be diseased, if they are both so, and if the different orifices be free or contracted by ossifications, which we can rarely guess by any other means.

Shall we be told that so minute an acquaintance with the state of the diseased part serves the treatment in no degree; that it is but a useless display, embarrassing to the physician, and disagreeable to the patient? But even were this the fact at present, who can answer that that which is now a superfluity, when pathologic physiology is so little advanced may not afterwards become of real utility? Besides, has the merit of the dis-

* This assertion is perhaps too bold; since it is well known that persons of quick observation are liable to make mistakes before they acquire precision in the use of the instrument.—ED.

coveries of the medical anatomists, who have described tubercles, scirrhus, medullary fungus, and melanoses been contested, although the practical physician can draw no advantage from this knowledge for the treatment of these diseases?

Will the necessity for the cylinder be contested, if I prove that these affections never unmask themselves but when they are of long standing, and almost incurable; and that they have a first stage in which they necessarily escape us, and auscultation alone can enable us to recognize them? To come to this result, let us examine what takes place in these diseases; and as it would be tedious to review them all, let us take hypertrophy for an example, affecting the left or right ventricle.

What happens, when the left ventricle is hypertrophied?

The blood is pushed with more force into the arteries; these vessels having thin and resisting walls cannot experience any violent lesion from this too energetic shock, even should the disease not develop itself slowly, and give them time to accustom themselves

to its first effect. The fatal influence is then borne upon the capillary system. This system, which is very much extended, and disposed so that the circulation may meet no obstruction, communicates freely with numerous vessels, which in the ordinary state contain no blood, but which numerous natural phenomena demonstrate their disposition to admit, and the possibility of its circulating in them without danger. All this vascular network enters into the composition of organs, firm enough to support it, whose multiplied movements powerfully favor its circulation. The sanguineous capillary system empties into these multiplied canals the superfluity it cannot hold.

The impulse of the blood, already weakened by the long passage it has already run in the arteries, loses still more of its force by dividing, and limits its effect to advancing the progress of the blood in the capillaries, and afterwards in the veins; so that a new equilibrium, we may say, is established between the arteries and the veins; all the organs are more supplied with blood, gorged, and the symptoms confine themselves to

those of plethora, without any one indicating the particular cause of this state of general turgescence.

This first stage is entirely latent ; and the symptoms recognizable as signs of hypertrophy of the heart, will only appear in the second stage, about to be considered.

At the end of a longer or shorter time, according to the subject, some capillaries, weakened by this constant tension, this permanent state of action, dilate and are obstructed ; this takes place commonly in the lower extremities, in which many causes of dilatation act. The obstruction is propagated slowly, nearer and nearer ; the first symptoms of serous cachexy appear in the extremities. The column of blood propelled by the heart has already fewer outlets ; they diminish still more every day.

Very soon obstructed in its course, the capillary system offers a continually increasing obstacle to each wave sent to it by every contraction of the ventricle. This not being able to unload itself of all the blood it contains, ceases to admit all which the lungs transmit to it. The veins of that delicate organ

promptly experience the same alterations as the general capillary system. The catarrhal affection, concomitant of diseases of the heart, develops itself, and death delays not long his arrival, preceded by all the incidents which the simultaneous lesion of the heart and lungs can produce.

In the commencement of this stage the complaint is already severe, and still the symptoms are but little characteristic. It is only towards the end, at a period near the conclusion of the disease, then necessarily fatal, that the combination of symptoms which denote it are developed, and manifest themselves evidently.

In hypertrophy of the right ventricle, it is still more indispensable to employ a means which may make known the disease at the commencement; for the first stage is very short, and the disease acts upon an organ the most essential to life, the texture and functions of which it quickly alters. In fact the column of blood, propelled by the hypertrophied ventricle with too much force, strikes against arteries with thin coats, easily extensible. These arteries are very short, and

terminate in an excessively fine network, very near the point of departure of the blood, so that the shock has lost nothing of its force when it arrives there. This capillary system is plunged into a soft, vesicular organ, which lends it no support; it cannot, like the general system, subdivide itself, as we may say; and its circulation is not forwarded by sufficiently numerous or powerful movements. So unfavorably disposed to answer or yield to the increased force of the ventricle, these vessels soon dilate; their tonicity is lost; they become obstructed; the blood stagnates in them, and opposes a daily increasing resistance to the column of blood circulating in the arterial trunks. The right ventricle ceases to admit all the blood brought to it by the veins; local congestions form, both exteriorly and interiorly; œdema develops itself in several parts; the catarrhal and œdematous state of the lung has already long existed.

However, this varicose state, as it may be called, obstructs the purification of the blood, the air can only act upon the smaller quantity now circulating in the lung; the left ventricle

receives little of it, and transmits little to the organs ; the general debility increases every day, and the exhausted patient sinks, after having experienced, but at an earlier period, the same affections as in hypertrophy of the left ventricle.

We observe here, in the first stage, only an alteration of the lung, which is at first slight, and necessarily confounded with some other affection of that organ ; and when the local congestions and the œdema lead us to suspect the primitive affection, the secondary disease is already as much and more difficult and dangerous to cure. With what eagerness ought we not to embrace a method which furnishes certain data in such dangerous cases, at the only period in which it is possible to combat and overcome the disease ?

These considerations prove the utility of the cylinder, particularly when the phenomena we observe can be referred to no well known lesion ; they explain also the differences presented by two similar affections occupying different parts of the same organ. Thus we see why bloodletting, which gives so much relief in thickening of the left ven-

tricle, produces little effect in that of the right : why in the first the catarrh develops itself later than in the second ; why œdema of the lung is more frequently and rather a disease of the right ventricle, than of the left ; why the expectoration of bloody sputa—not unlike the blood which escapes from varicose vessels—takes place oftener in the former than in the latter ; finally, why the right ventricle constantly acquires less thickness than the left.

We also easily explain the difference of countenance peculiar to each of these affections, and the state of the pulse in both.

I return to my subject, from which I have let myself be drawn so far, by the desire of proving the importance of auscultation in diseases of the heart.

Considering the application of the stethoscope to the diagnosis of these diseases, I shall divide them into those characterized by alteration of the shock, those known by the alteration of the sound, and those in which both have experienced alterations ; finally, I shall treat of aneurism of the aorta, and of pericarditis. This division compre-

hends neither ruptures of the heart, nor its faulty degeneration, its induration, its inflammation, nor the diseases of the auricles. For want of observations, I am ignorant what signs the cylinder yields in those affections.

ART. I.—*Diseases characterized by alteration of the shock.*

Hypertrophy. The enlargement of the heart causes no alteration in the movements of the thorax, which is peculiar to it, or affording one of its signs. Those which we observe always depend on the state of the lung, which is readily affected in this complaint; they generally consist in an habitual dyspnœa, increasing in paroxysms, carried at this time, and during the latter moments of life, to a state of orthopnœa,

Percussion rarely furnishes any results; however, in some cases of very severe hypertrophy, the sound has been observed to be obscure or flat in the precordial region.

The investigation by means of the cylinder produces more certain and constant results. The contraction of the ventricles gives

a strong noiseless impulse, prolonged in proportion to the extent of the hypertrophy, often limited to a space smaller than in the healthy state. Sometimes the pulsations are irregular, intermittent; most commonly their rhythm experiences no other alteration than an increased duration of the ventricular contraction. Then that of the auricles takes place before that of the ventricles is finished; it is short, attended with little noise, and for that reason scarcely sensible.

These phenomena are perfectly distinct in all cases so long as respiration remains free, or is little disturbed. If the dyspnœa becomes extreme, they often disappear, and only become evident in moments of repose.

Hypertrophy of the left ventricle. If this ventricle alone is enlarged, the symptoms just pointed out will be perceived only between the fifth and seventh left sternal ribs, and investigation of the lower part of the sternum will make known the integrity of the right ventricle.

Hypertrophy of the right ventricle. When this side is diseased, the contrary happens. The sound of the ventricular contractions is

dull, but it never becomes as much so as on the left side.

The comparison of the two ventricles, which is always easily made, gives great facility and certainty to the diagnosis in this disease.

ART. II.—*Disease characterized by alteration of the sound.*

Dilatation of the heart. There are the same alterations of the respiration as in hypertrophy, but in a less degree, and less subject to paroxysms. The sound on percussion of the precordial region is sometimes a little obscure; there is a sonorous noise on the contraction of the ventricles, in extent always proportioned to the degree of dilatation; very little shock: such are the signs of dilatation.

This disease rarely effects the two ventricles together; it is more common on the right than the left side. The place where the sonorous, clapping sound is heard with most force, indicates which ventricle is dilated.

Sometimes one side of the heart is dilated, the other hypertrophied ; we then find signs of dilatation on one side, and of hypertrophy on the other ; and the place where each set of signs is met, makes known the seat of each affection.

ART. III.—*Diseases characterized by alteration of impulse and sound.*

Dilatation with Hypertrophy. The signs of this affection are a combination of those of hypertrophy and those of dilatation.

The contractions of the ventricles cause at once a strong impulse, and a distinct sound ; those of the auricles are sonorous ; the pulsations spread over a great extent, and in thin persons and children the impulse is evident over almost the whole chest. This is the complaint, in which the contractions are easily felt by the hand, and produce an evident palpitation, discernible at some distance ; the rhythm of the pulsations is rarely altered. It is in cases of dilatation with hypertrophy, also, that percussion causes an almost perfectly flat sound.

As in the other varieties, the place where these phenomena are observed, shows the part of the heart which is affected, if only one half of that organ is affected.

Contraction of the orifices of the Heart. M. Lænnec mentions the bellows blast, and the rasp sound, as signs of this contraction, whatever may be the cause which produces it.

The first of these phenomena often exists, without any lesion of the orifices. I have not had sufficient opportunity of convincing myself of the proper value of the second.

These sounds attend the contractions of that part of the heart where the orifice is narrowed; thus in the narrowing of the valve, it attends the contraction of the auricle; when one of the arterial orifices is contracted, the sound accompanies the systole of the ventricles.

The alteration of the orifices usually brings on hypertrophy of the part of which it restrains the action, and the signs of this are joined to the rasp sound, or the bellows blast.

Softening of the heart. We may consider this to exist when the heart returns a sound

equally moderate, dull, and obtuse in its two contractions, and communicates little or no impulse. If the noise caused by the heart's contractions, although loud, is rather flat, and loses the clapping character usually attending dilatation, the softening is attended with that state; but if the sound of the contraction is so indistinct as to be almost no longer heard, it will be accompanied by hypertrophy.

Sometimes, however, in attacks of palpitation, a softened hypertrophied heart may produce brisk contractions, short, and like the blow of a hammer, but this effort is of short duration, and the organ very soon falls back into its habitual state.

ART. IV.—*Aneurism of the Aorta.*

This disease may sometimes be recognized by simple pulsations, felt at some part of the upper and anterior part of the breast, or along the vertebral column.

These pulsations, which are always synchronous with the pulse, have often more force and sound than the ventricular contractions; but those symptoms are most frequently absent.

Two months ago, a woman laboring under this disease was in the Neckar hospital, in whom the tumor distinctly projected at the right side and upper part of the sternum beneath the first ribs. I examined her frequently, and could only observe the following phenomena:—The right ventricle yielded little impulse or sound; the left communicated a very energetic shock; its sound was dull: it was felt much more to the left than usual: I do not know whether this was natural, or the effect of disease. On applying the cylinder upon the sternum, a little above the heart, the contractions could be feebly heard, but not at all felt. Over the whole extent of the tumor they were heard double and tolerably loud, and a well marked impulse was besides felt at the moment of the contraction of the ventricles.*

* *On the use of the Stethoscope in Internal Aneurism.*

In aneurism examined by the stethoscope, there is a peculiar sound, different from that of the heart, and different also from that of the great arteries in their natural condition (which it may be difficult if not impracticable to describe so as perfectly to convey the idea in words to one who has never observed the pecu-

ART. V.—*Pericarditis and Hydropericardium.*

M. Lænnec mentions the increased impulse and sound of the ventricular contrac-

liarity upon the living body,) which is nevertheless characteristic of aneurismal dilatation. A person who has, in a single instance of well-marked aneurism, carefully investigated and observed the phenomena perceptible to the sense of hearing by means of the stethoscope, will readily recognize this peculiarity of the sound. This is not confined to aneurism of the large internal arteries,—the Editor of the present edition having observed it in inguinal, femoral, popliteal, brachial aneurisms, as well as in those of the larger arteries within the chest and abdomen. In a case of varicose aneurism of the arm, produced by transfixing the vein and wounding the artery in bleeding, the sound produced, when examined by the stethoscope, might be compared to that of a circular saw acting upon wood, one small portion of the circle bearing in a less degree upon the wood than the remainder of the circle; but the diminution of the sound scarcely amounting to a perfect intermission.

The same sound, in a less degree, has been observed in varicose aneurism of the temporal artery, produced by the operation of cupping.

In the discrimination of internal aneurism much may be ascertained by the physiological pathologist

tions, with their inequality and disproportion to the feebleness and smallness of the pulse, as signs of pericarditis. Perhaps the noise which I have compared to the creaking of leather, is a symptom of this affection ; it is one of short duration, limited to a few hours, if the disease is acute, and quickly producing effusion ; more durable when the progress is slower. The friction of the two lamina of the pericardium, deprived of the serious exhalation, by the inflammation, may explain the sound.

This dryness seems to be the effect of inflammation upon serous membranes. Thus, we observe it in coryza, upon the nasal mucous membrane ; in rheumatism, upon the synovial membranes ; and when the latter affection is chronic, and without effusion, we may produce the same kind of sound, in

without the aid of the stethoscope ; but there are cases in which all the corroborative signs afforded by ordinary means of investigation amount only to a probable conjecture of the aneurismal nature of the disease, in which the stethoscope, to the attentive and well-practised observer, affords evidence so unequivocal that it may almost be deemed demonstrative.—ED.

the knee for example, by rubbing the rotula upon the condyles.

The severe pain seated in those parts, when the disease is acute, has hindered me from trying whether the same phenomenon exists at that time. But it is invariably true, that the symptoms of effusion into the sac are rarely observed on the first day.

As to dropsy of the pericardium, the only symptoms which can lead us to suspect it, are a completely flat or fleshy sound in the precordial region, and tumultuous and obscure pulsations of the heart, sensible in a great extent, and for some moments more at one point than at others, and reaching the hand, as if a soft body were interposed.

EXPLANATION OF THE PLATES.

PLATE I.

The Plate represents a front view of the VISCERA OF THE THORAX, the sternum and the anterior parts of the clavicles and ribs having been removed.

The chief points of demonstration are the following :

The sections of the ribs, which are marked numerically, the figure 1 being placed on the uppermost rib.

† marks the portions of *the clavicles*.

RELATING TO THE LUNGS AND AIR PASSAGES.

a, is placed upon the *thyroid cartilage*.

b, *The trachea*, at the upper part of which, and immediately below the larynx, is seen the *thyroid gland*.

c, d, e, *The lobes of the right lung*.

† *The edges of the pleura* may be seen surrounding the lungs and covering the upper portion of them.

f, g, *The lobes of the left lung*.

THE HEART is seen surrounded at its circumference by the edge of the divided *pericardium*, which at the upper part is seen crossing over the great vessels.

The principal points relating to the HEART AND GREAT VESSELS are,

h, *The vena cava descendens*.

i, *The right auricle*.

k, *The right ventricle*.

l, *The pulmonary artery*.

† *The left auricle*, a small portion only of which is seen between the root of the pulmonary artery, the pericardium, and the top of the left ventricle.

m, *The left ventricle*.

n, *The ascending aorta*, within the pericardium.

o, *The arch of the aorta*, after it has emerged from the pericardium, crossing over and resting upon the trachea.

EXPLANATION OF THE PLATES.

Arising from the arch of the aorta are seen the three great trunks which supply the head, neck, and upper extremities : on the right, the *arteria innominata*, dividing into the *right subclavian* and the *right carotid* ;—on the left, the *left carotid* and the *left subclavian*, arising separately from the aorta.

The contiguity of these great vessels to the air passages, renders a knowledge of their situation and relations of great importance to the pathologist.

PLATE II.

ILLUSTRATIONS OF THE STETHOSCOPE.

The forms of the Instrument which have been approved, together with the proportions and dimensions of the different parts, are shown according to a scale.

AAA, The top of the upper piece for applying to the ear.

BBB, The lower end of the same piece hollowed out to receive the upper convex end of the second piece, and occasionally the stopper.

CC, The upper end of the 2d piece rounded to fit the concavity of the end *B*.

DD, The lower end of the same hollowed to receive the stopper.

EE, The stopper made to fit the lower end of the other two pieces.

A brass tube passes through it and projects beyond it, to keep it more firmly in its place, when applied.

FFFF, A canal perforating the whole length of the instrument.

The upper piece may be used alone or with the stopper occasionally, the 2d piece being laid aside.

PLATE III.

This figure exhibits the effects of contraction of the chest consequent on pleurisy.

a, The sound side.

b, The contracted side.

PLATE IV.

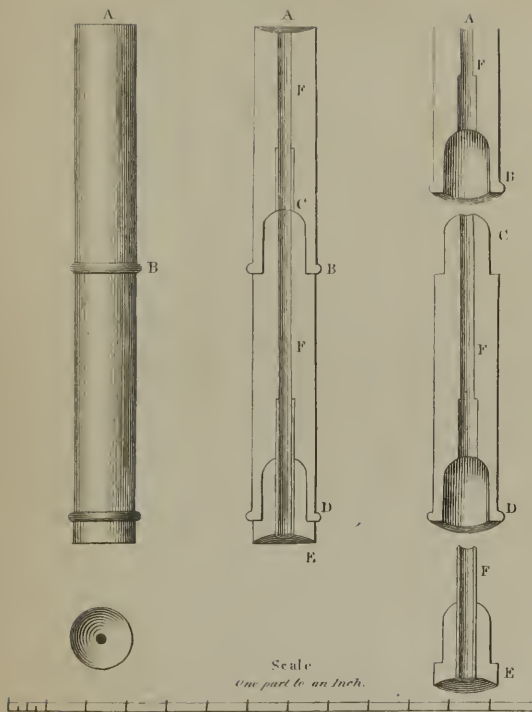
A back view of the same subject.

PLATE I.



The Viscera of the Thorax.

PLATE II.



THE STETHOSCOPE.

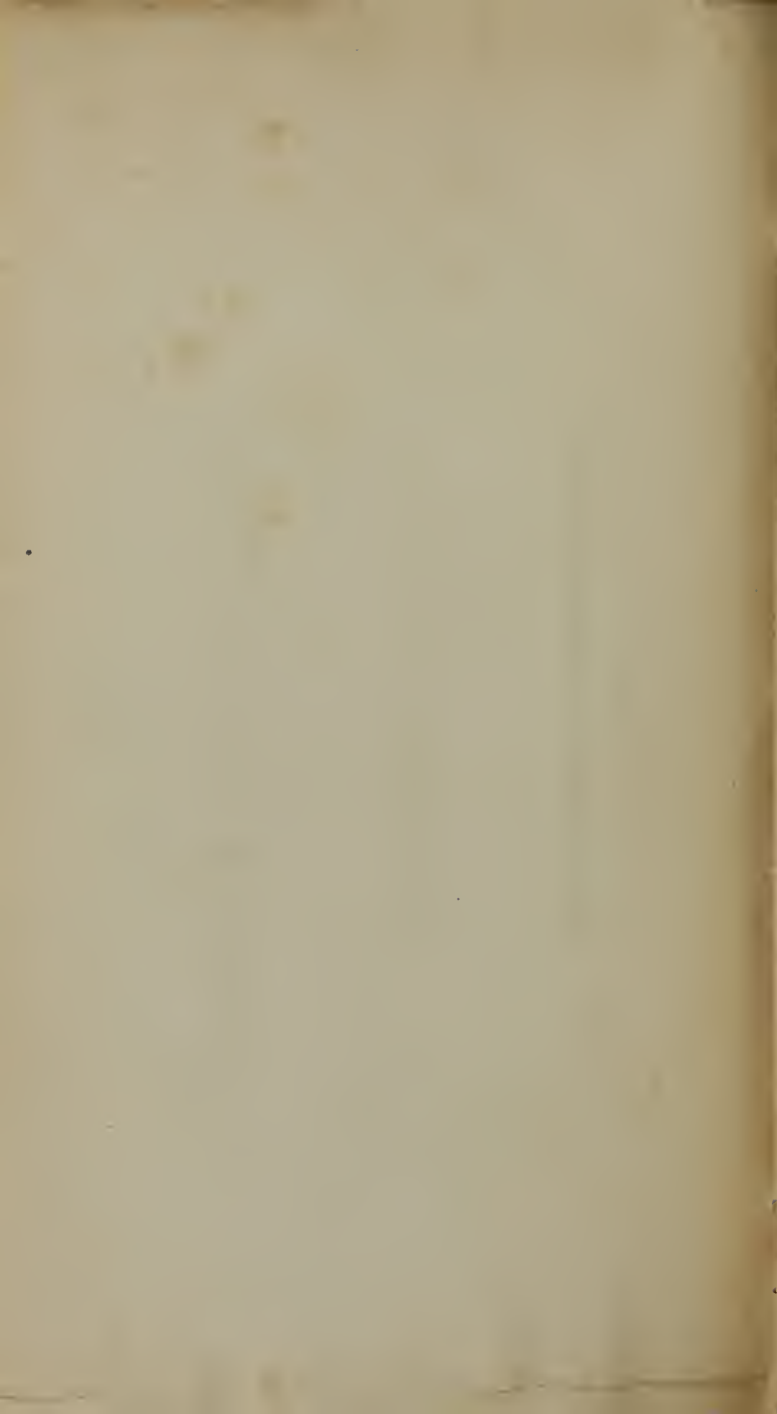


PLATE III.





PLATE III.



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